UNDERSTANDING A FOLKSONOMY AS A WEB CLASSIFICATION

by

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ABSTRACT

Despite increasing interest in folksonomy in practice as well as in research, little has been done to build a solid conceptual framework to understand how people classify Web resources using a folksonomy. This study is an attempt to articulate a conceptual framework that will help us better understand users' interactions with a folksonomy. The conceptual framework consists of three components of users' interactions with the folksonomy: (1) tagging – cognitive categorization of an individual user with a Web accessible resource; (2) navigation – exploration and discovery of Web accessible resources in the folksonomic system; and (3) knowledge sharing – representation and communication of knowledge within a domain that consists of a group of users who share the same interests or goals. The current study is exploratory and descriptive, focusing on the first component of users' interaction with a folksonomy, tagging. The purpose of this study is to explore how users are tagging in order to utilize a folksonomy; and whether or how they understand the social and interactive aspects of tagging in three different folksonomic systems, Connotea (www.connotea.org), Delicious (http://delicious.com), and CiteULike (www.citeulike.org). The study uses Web questionnaires, qualitative diary studies, and follow-up interviews to

understand 12 participants' tagging activities associated with folksonomic interactions. The flow charts developed from 12 participants showed that tagging was a quite complex process, in which each tagging activity was interconnected, and a variety of folksonomic system features were employed. Three main tagging activities involved in the tagging processes have been identified: item selection, tag assignment, and tag searching and discovery. During tag assignment, participants would describe their tagging motivations related to various types of tags. Their perception of the usefulness of types of tags was different when their purpose was social sharing than when it was personal information management. While tagging, participants recognized the social potential of a folksonomic system and used interactive aspects of tagging via various features of the folksonomic system. It is hoped that this empirical study will provide insight into theoretical and practical issues regarding users' perceptions and use of folksonomy in accessing, sharing, and navigating Web resources.

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1. INTRODUCTION

1.1 Problem statement

Classification, the putting together of like things, is the prototypical way of organizing information. In recent years, the folksonomy has been developed as a new concept in user-created classification and communication tools through shared metadata in the Web environment (Guy & Tonkin, 2006). The term, folksonomy was first coined by Vander Wal to denote "a practice of collaborative categorization using freely chosen keywords by a group of people cooperating spontaneously" (Quintarelli, 2005, p.5). The freely chosen keyword is referred to as a 'tag'; and tagging is the process by which users assign one or more tags to Web resources with a purpose to share, discover, and recover them.

Folksonomies feature prominently on a number of well-known Web-based information systems such as Amazon.com. Typically, such sites allow users to publicly tag and share their tags and resources, so that they can not only classify information for themselves, but can also browse the information classified by others (Golder & Huberman, 2006). A folksonomy encourages users to organize information in their own way and involves users actively in the organizational system (Mathes, 2004). In this sense, a

folksonomy has the potential to serve as a Web classification that allows users to interact within a system and to participate in the development of a classification system on the Web. In this study, interest in folksonomies arises from this relation between folksonomies and Web classifications, i.e., how a folksonomy differs from other types of Web classification and how users contribute to the development of a Web classification system.

A number of bloggers and technology critics such as Shirky (2005) explore the value of folksonomies, pointing out that they offer a natural and evolving way of organizing information. Although there is little peer-reviewed research on folksonomies, most of the discussion has focused on the structure of folksonomies, which emerges from the tags chosen by the users. A number of researchers have discussed the usage pattern of tags in particular systems. In particular, Golder and Huberman (2006) analyze the structure of folksonomy in Delicious[1], a folksonomic system with a community consisting primarily of technology and Web developers, and demonstrate that the tags applied to a given item appear to stabilize over time. They hypothesize that the set of people who classify an item stabilize on a set of terms in large part because people are influenced by the tagging behavior of others (Golder & Huberman, 2006). However, there has been no further study

[1] http://delicious.com/

to examine the idea that seeing others' tags influences behavior. Similarly, a number of studies examine the structure of folksonomies, focusing on the formation and distribution of tags, or the pattern of tags used in a folksonomy (i.e., Fokker, Pouwelse, & Buitine, 2006; Golder & Huberman, 2006; Guy & Tonkin, 2006; Kipp & Campbell, 2006; Lin, Beaudoin, Bui, & Desai, 2007; Marlow, Naaman, Boyd, & Davis, 2006; Voss, 2006). These studies primarily focus on the distribution of tags based on quantitative tag analysis, and little is known about users' perception and evaluation of folksonomies based on qualitative user analysis.

There has not been much empirical study involving real users which addresses how people view and use a folksonomy in practice. We need to explore the usage of folksonomies in an everyday context by asking people how they use a folksonomy for organizing Web resources and what their information needs are in using a folksonomy. Although our knowledge of folksonomy is growing, it is still not known how users classify items in a certain category and why they name these categories with specific words (Mathes, 2004). It is also important to explore how feedback affects users' tagging behaviors; in other words, when a system shows the tags by which different users classify the same items, does it affect their tag use, and if so, how do users modify tags? To address these questions,

this study takes a qualitative approach to understand the usage and perception of folksonomy as a Web classification.

The overall purpose of this study is to explore how people use and perceive the folksonomy they work with as a classification in accessing, sharing, and navigating Web resources. The current study focuses on users' tagging behaviors involved with the folksonomic interactions. Based on information scent and foraging theory, this study investigates how people are tagging in order to utilize a folksonomy. Information scent is a key concept of information foraging theory which denotes the adaptive information seeking behavior of users within the Web interaction environment (Pirolli & Card, 1995). This theory posits that users rely heavily on information scent which is produced by the "environmental cues in judging information sources and navigating through information spaces" (Pirolli, 2003, p.158) in order to optimize their search outcomes. Based on information foraging and scent theory, this study explores information scent in folksonomy in order to better understand users' interactions with a folksonomy through tagging. This investigation will provide a new insight on the use of folksonomy, i.e., how tags and a folksonomy function as information scent which guides users to the information they seek and helps them to predict which resources will be pursued.

1.2 Research objective

The overall objective of this study is to explore how individuals use and understand a folksonomy in organizing Web resources. This study suggests a conceptual framework to better understand interactions among users, a domain, and a folksonomic system. A proposed framework consists of three components of users' interactions with the folksonomy:

- Tagging – cognitive categorization by an individual user of a Web-accessible resource;
- Navigation – exploration and discovery of Web-accessible resources in the folksonomic system;
- Knowledge sharing – representation and communication of knowledge within a domain.

The current study is the beginning of a much larger research project to build a sound, comprehensive conceptual framework to understand users' interactions with a folksonomy as described above. This study focuses on the first component of users' interaction with a folksonomy, tagging. This study is an attempt to better understand the tagging behaviors of

users engaged in the folksonomic interactions. It addresses these important issues with an approach designed to explore end-user perspectives:

(1) to examine how people are tagging in order to utilize a folksonomy in the practice of organizing Web resources; and

(2) to examine whether and how people are interacting with a folksonomy through tagging.

In so doing, the study will shed light on theoretical as well as practical issues regarding users' perceptions and use of folksonomy in accessing, sharing, and navigating Web resources.

1.3 Research questions

The following research questions were explored in this study:

1. How do participants tag a resource using a folksonomic system? What activities are involved in the tagging process?
2. What are the motivations of participants behind tagging activities? How do they relate their tagging motivations to their tag decision?
3. How do participants understand the social and interactive aspects of tagging? To

what extent do they consider others' tags and tagging behaviors during tagging?

These questions are addressed by the description and analysis of participants' tagging activities associated with folksonomic interactions through Web questionnaires, qualitative diary studies, and follow-up interviews with participants. The first research question explores how individuals tag a resource when using folksonomic systems. This examination of the tagging processes of participants entails a detailed description of tagging processes, including a series of tagging activities involved, types of tags they use, and features of folksonomic systems they use. The answers to this research question will strengthen our understanding of tagging practices.

The second research question examines the motivations of participants behind their tagging activities: how individuals relate their tagging motivations to their tagging activities. This examination considers what participants' motivations for tagging are, and how these motivations guide their tag decision. The answers to this research question will help us better understand why individuals choose the tags they use.

The third research question examines the social and interactive aspects of tagging that participants perceive. The study examines how individuals understand the social and interactive aspects of tagging, and how their perceptions affect their tagging activities. By

looking at the social and interactive aspects of tagging, the study will help us better understand how individuals interact with a folksonomy through tagging. The answers to this research question will also provide some insights on the role of tag as information scent.

1.4 Significance of the research

This empirical study will contribute to a better understanding of users' tagging behaviors and will help to develop a conceptual framework that address users' interactions with a folksonomy. In this study, a conceptual framework that consists of three different components from users' points of view is proposed: tagging, navigation, and knowledge sharing. The current study is an attempt to test the first component, users' tagging behaviors engaged in the folksonomic interactions. An understanding of individuals' tagging behaviors and their awareness of the social and interactive aspects of tagging will help lay the foundation for future research on folksonomic interaction. The empirical findings of this first phase of study will provide the foundations for a larger body of research focusing on the development of a theoretically sound conceptual framework for folksonomic interaction research.

This first phase of research on folksonomic interaction will contribute to a better

understanding of users' perceptions and evaluation of a folksonomy in the practice of organizing Web resources. The study differs from prior studies which explore the structure of folksonomy based on tag analysis. The current study focuses on people, looking at how they use and understand a folksonomy in practice, and thus will be able to provide a realistic view of the folksonomy as a Web classification. The questions addressed by this study from a user behavior perspective, will give a fresh insight into a useful framework to construct and evaluate a folksonomy, thereby improving this ubiquitous social technology.

The empirical findings of the study will also present more insightful knowledge on information scent within a folksonomic system and in a broad sense, Web-based information systems incorporating classificatory structures. By identifying the factors that affect users' interaction, including users' perception of that information environment, the study will suggest ways to improve navigation effectiveness.

The empirical findings, including users' perception of the folksonomic information environment, will provide the foundations for further investigation into more theoretical questions as well as inform practical design related to developing information scent in a folksonomic system. It is hoped that the findings relating to the factors which affect users' interaction will give insight into ways to improve navigation effectiveness and to inform

design in practice.

2. LITERATURE REVIEW

2.1 Introduction: Two dimensions of folksonomy

The current study on folksonomic interaction concerns itself with two dimensions of folksonomies. One dimension of interest is how people use a folksonomy as a Web classification, which puts like information together in a Web context. The other dimension of interest is how a folksonomy is structured through users' interactions, using information foraging and scent theory.

The first dimension, a folksonomy as a Web classification, raises fundamental questions about folksonomy: Can we see a folksonomy as a type of Web classification? If so, how does the theory of classification apply to the structure of a folksonomy? How different or similar is folksonomy to a traditional classification approach? What classification theories are useful to construct or evaluate Web classification including folksonomy? Can traditional classification theories and practices as developed in the bibliographic context be transferred to the Web classification context, or do we need a new theory? These questions are addressed by the literature review of classification theories. The review will lead to the conceptualization of folksonomy of this study as a Web classification which reflects an interaction among users, a domain, and a classification

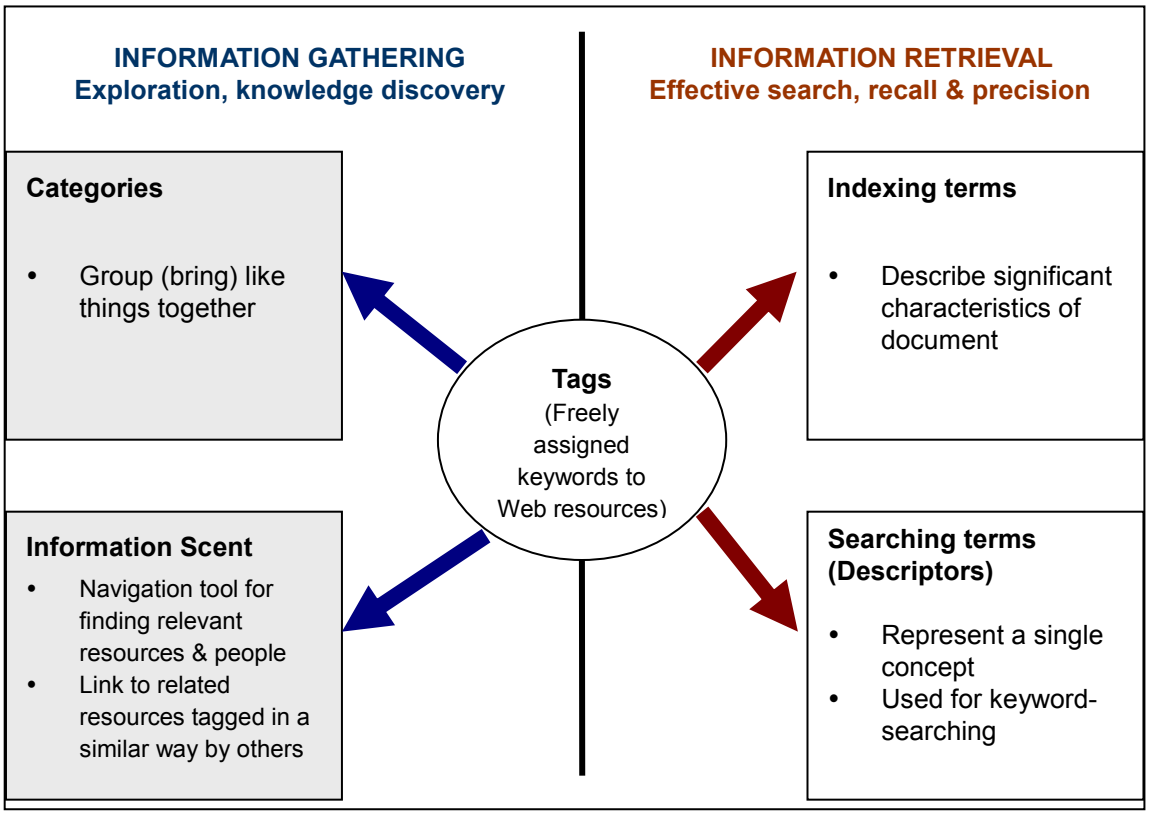
structure.

The second dimension, a folksonomy as information scent, raises questions regarding how to identify users' interactions with a folksonomy using information foraging and scent theory: What are information foraging and scent theories? How are information foraging and scent theories used to understand Web interaction? How can we apply these theories to explore folksonomic interaction? These questions are addressed by the review of information foraging and scent theory. The review will help with building an exploratory model to study users' interactions with a folksonomy.

These two dimensions of folksonomy taken together provide useful insight into the ways in which folksonomy serves as a Web classification that reflects an interaction among users, a domain, and a classification structure. In addition, the two dimensions of folksonomy inform the approach used in this research study, an exploration of tags and the act of tagging. This study seeks to address tagging as it is related to information gathering and browsing behavior because "people are constantly gathering, monitoring, and screening information around them as they go through daily life" (Rice, McCreadie, & Chang, 2001, p.8), in contrast to directed searching and information retrieval. Figure 2.1 illustrates the approach of this study to understanding tags as categories and information scent,

contrasting with the approach that sees tags as indexing and searching terms. The left side of Figure 2.1 indicates the scope of this literature review and interests in tags. This review will shape our understanding of tags as categories which put like things together, and as information scent which leads users to the information they seek. This literature review will provide a theoretical framework to conduct empirical research on users' tagging behavior which is involved with folksonomic interaction.

Figure 2.1 Approach to Understanding Tags



2.2 Folksonomy as a Web classification: The literature of classification theory

This review of classification theories addresses: (1) the classificatory approach of this study to understand folksonomy, as seen in the context of (2) a shift in classification study from traditional to contemporary conceptions of classification. This review provides a theoretical basis from which this study attempts to articulate that (3) folksonomy has the potential to serve as a reflective and interactive Web classification.

2.2.1 Classificatory approach to folksonomy

This section addresses how classification theories are related to our understanding of folksonomy as a reflective and interactive Web classification. The review focuses on core concepts that underlie the classificatory approach to folksonomy in this study. That is, in this study classification and categorization are understood as distinct but closely related to folksonomy in order to address the nature and structure of a folksonomy. The study also draws on a non-traditional approach to classification to understand that a folksonomy is created by users with an emergent categorical structure in a Web context.

(1) Classification & categorization

In Library and Information Science (LIS), classification is widely referred to as "the putting together of like things" (Hjørland, 2003, p.103). In a narrow sense, this meaning of classification can be separated into two concepts: the one in terms of classification as process, namely *classifying*; and the other in terms of classification as a product, namely a *classification system* (Kwasnik, 1999). As process, classification refers to the method of organizing information, which brings like information together and differentiates what is not like. On the other hand, as a system, classification refers to a representational tool used to organize a collection of information resources. These two concepts of classification are separable but closely intertwined because "a full appreciation of the implication of classification systems for organizing information resources requires a basic understanding of the classification process itself" (Jacob, 2004, p.5).The definition of classification as the putting together of like things is very broad, in contrast to that of many LIS researchers who have used the term classification with more restriction on meaning, to denote the identification of concepts and the relationships between concepts, and making both concepts and relationships explicit. The rationale for adopting a broad definition of classification in this study is that we cannot accurately describe the characteristics of

folksonomy, which does not semantically control terms to restrict their meanings and to make explicit the relationships they bear to other terms, using the restricted bibliographic concept of classification. To deal with the semantic ambiguity of folksonomy, broad approaches to the definition of classification based on the sharing of some similarity rather than essential properties will be introduced.

In terms of process, classification is often used with the term "categorization" in the literature. This is because categorization is a fundamental thought process in the human mind and is the most natural way we know to organize information (Iyer, 1995). Categorization is the process by which our conceptual structures are formed. Every time we see something as a kind of thing, we experience and understand ideas and objects by grouping them in useful ways (Lakoff, 1987). This process is reflected in the design of classification systems such that "the individual, idiosyncratic categories that each person forms are abstracted into more formal and general categories that can be logically perceived and used by anyone" (Iyer, 1995, p.88). A more thorough understanding of classification, therefore, is based on the study of categorization (Iyer, 1995).

Theories of categorization have developed into two distinct paradigms: the classical approaches and other alternative approaches to categorization (Iyer, 1995, p.41-55; Jacob,

1991, 2004; Lakoff, 1987). The central assumption underlying the classical theory of categorization is that categories are defined only by a set of properties that all members share. This classical theory rests on three assumptions:

- The definition of a category is the union of the essential features that identify the memberships of that category;
- The defining features for a category are both individually necessary and jointly sufficient to define the category;
- Categories are nested, so that the subordinate category possesses all the features of the superordinate category (Iyer, 1995; Jacob, 2004; Lakoff, 1987).

On the other hand, alternative approaches to categorization criticize the classical view of categorization as incapable of accounting for the findings from empirical studies of categorization. Fieldwork in the area of cognitive psychology and anthropology shows that category members need not share a common property (Lakoff, 1987). Members can be similar to one another in different ways, for example on the basis of family resemblance, in the same way that the members of a human family may be related to one another without all having properties in common. The central argument made by alternative approaches is that human categorization is based on the nature of human bodies and our experience

(Lakoff, 1987).

In particular, Rosch's theory of prototypes and basic-level categories challenges the classical view of categorization, addressing the instability of category membership and graded category structure (Lakoff, 1987). These approaches account for asymmetries among category members and asymmetric structures within categories: members of categories are usually differentiated as prototypical or non-prototypical, which results in a graded structure (Iyer, 1995; Lakoff, 1987). Alternative approaches emphasize that categorization is not merely a conceptual structure which identifies the world, but a cognitive process which is closely associated with the way in which people perceive the world. Prototype effects, according to Lakoff, are a way of conceptualizing a category by holding certain examples as ideals. Prototype effects are superficial in that they may result from many factors (Lakoff, 1987). Prototypes can vary with culture and environment. People who hold different prototypes tend to think of categories differently, and to reach different conclusions. What constitutes a prototype category is also a matter of perspective; thus it may change as individual perception changes over time (Iyer, 1995).

These different approaches to categorization lead us to different understandings of classification. The classic theory of categorization has dominated our view of classification

in that it informs and directs the systematic assignment of entities to classes according to an established set of principles (Jacob, 1991). Traditionally, the classical approach is exemplified in normative principles of classification:

- The classes are strictly defined and mutually exclusive, and boundaries between those must be clear;
- The characteristics for division must be consistent and the characteristics should be relevant to the purpose of classification;
- In the successive division, classes have the lesser extensions and greater intension of a common characteristic (Ranganathan, 1967; Sayers, 1916).

Consequently, the classical approach to categorization entails a highly structured classification system. This manifests in a hierarchical structure of fixed classes that reflects logical genus-species relationships where classes should be mutually exclusive and totally exhaustive. In this case, classification establishes relationships between classes that are relatively stable and meaningful.

However, this classic approach to categorization cannot account for the formation and structure of a folksonomy in which idiosyncratic and communal categories coexist. Basically, a folksonomy allows users to classify Web resources in any sense which

represents the way they perceive them. These idiosyncratic categories, which are based on their own needs and ways of thinking, do not fit the classical approach to categorization, which cannot account for idiosyncratic categories defined by the variant ways in which individuals perceive and classify the world.

On the other hand, as a folksonomy encourages users to share their categories and the content with others, the communal categories are generated in their social context. Communal categories emerge in a collective pattern which seems to form from a nascent consensus (Golder & Huberman, 2006). Individuals tend to use the suggested popular categories, or imitate the category formation of others when they observe their categories (Campbell, 2006; Golder & Huberman, 2006; Shirky, 2005). The communal category of a folksonomy calls for a different classification theory which supports a broader view of classification. Campbell (2006) describes a folksonomy as follows:

> Classification, taken in its broadest sense as the act of gathering like things together in a useful way, can be done by end users, using their own words, and then using Web-based digital technologies to assemble their varied decisions together in new and interesting ways (p.2).

This implies that a folksonomy is related to alternative approaches to categorization, that is dividing the world into groups of entities whose members are "in some way similar to each other". The formation of categories depends largely on who does the defining; thereby

categories are embodied in the individual's cognitive models.

A folksonomy can be thought of as a loosely structured classification system in which categories are not rigidly bounded but frequently overlapping. A folksonomy generally does not provide hierarchical relations between categories. It merely provides a flat space in which related categories are automatically generated based on common URLs that a group of users tagged (Mathes, 2004). This conception of a loosely structured classification system is in line with the alternative approaches to categorization that maintain variant cognitive frameworks which individuals impose on their experience of the world. Categories represent "variable clusters of entities which may or may not be organized in a hierarchical structure" (Jacob, 2004, p.11). Also, membership in one category does not prohibit membership in any other category because categories are not constrained by a requirement for mutual-exclusivity. From this view, a folksonomy relies on an individual's ability to form the categories as a function of immediate context, personal goals, or past experience. This is in line with Jacob's conception of categorization (Jacob, 2004). In contrast to a highly structured classification system, this plasticity may prohibit the use of classification as a persistent information structure though it reflects variant contexts of users (Jacob, 2004). However, as the empirical work of Golder and Huberman (2006)

reveals, the communal category demonstrates important implications for the stability of structure using its social aspect. The stable, consensual choices that emerge can be used on a large scale to describe and organize how Web resources interact with one another (Golder & Huberman, 2006).

To summarize, theoretically classification is has been discussed from two perspectives: as a highly structured classification system which is based on classical theory of categorization, and as a loosely structured classification system which is based on alternative approaches to categorization. A highly structured classification refers to a hierarchical structure of mutually exclusive and non-overlapping classes nested in genus-species relationships. In contrast, a loosely structured classification allows the membership of any two or more categories to overlap or vary across time in response to changing context (Jacob, 2004). Both highly structured and loosely structured classification systems have advantages and limitations. The former is considered to be relatively stable (Iyer, 1995). However, it does not yield universally useful and acceptable systems because it presupposes precise contexts, but individuals are not usually in the same context (Priss, 2001). On the contrary, the latter has the plasticity which reflects an individual's variant contexts though it is relatively inconsistent and constantly redrawn according to their

perspectives.

Looking at classification through this dichotomy of the classical and alternative approaches to categorization can provide new insights on folksonomy. Alternative approaches to categorization offer us a way to understand how people form categories and structure a folksonomy. That involves a dynamic and creative process of classification in which an individual represents the world as a function of context, goals, and experience of his or her own. Categories reflect the way individuals classify things at the moment, to express their immediate information needs (Iyer, 1995). A folksonomy is consistent with a loosely structured classification system in which categories are fuzzy and without precise definitions or clear boundaries. In terms of graded structure, the definition and organization of categories depend largely on who does the classification. Categories are constructed based on the individual's cultural and social context, as shown by Lakoff's (1987) example in which women, fire and dangerous things are classed together by the classification system of Dyirbal, an aboriginal language of Australia, although they seem to share no common properties. Fire is linked to women, the central subcategory, because it occurs in the same domain as the sun, which in myth is a wife (the moon being her husband) and therefore classed like other wives with women. Dangerous things are linked with fire and classified

with fire and women because fire occurs in the domain of dangerous things (Lakoff, 1987). Thus, we view a folksonomy as classification that is not a structure for defining the universe, but a process of grouping like things together in a way which users perceive to be useful.

(2) Web classification

LIS researchers have attempted to explore the value and role of classification for systematic organization of the Web. There have been numerous attempts by the classification research community to re-examine the theories of classification and to apply them in the Web environment. This section presents an overview of Web classification which, in this study, is defined as putting like Web-accessible resources, e.g., a photo, a blog, a Web site, or an article accessible on the Web, together. To fully understand the concept of Web classification, this review summarizes two kinds of use of Web classification found in practice: (1) existing classification systems such as the Dewey Decimal Classification (DDC) and Library of Congress Classification (LCC); and (2) custom-built classification systems such as the Yahoo! Directory.

The first kind of Web classification uses existing classification systems and standard

bibliographic techniques, in order to group resources into related categories in a Web context (Chan, 2001). These systems include well-known projects such as DDC in NetFirst, CyberDewey, and the Renardus Project (Koch, Neuroth, & Day, 2003) and the use of LCC outlines in Cyberstacks and the Internet Scout Project. Many digital library initiatives, such as Scotland's Culture portal, have resources indexed using Library of Congress Subject Headings (LCSH). In such cases, the issues of flexibility in the depth of the hierarchy and multiplicity in the collocation of items in the array are important to facilitate users' subject access to Web resources (Chan, 2001). For example, the Internet Scout Project provides multiple subject access points and uses words, rather than notations, in order to facilitate public access (Olson & Boll, 2001).

The second kind of Web classification is devised by popular Web search services, portals or local systems. These classifications are devised to support users in navigating and retrieving Web resources. They are widely used in portals (e.g., Yahoo!, Lycos, DMOZ which Google incorporates, Infoseek, Excite) and commercial sites (e.g., Amazon) (Dempsey, 2000). Most of these systems are commercial services aimed at a broad audience. Therefore, classification typically consists of broad categories and subcategories based on popular interest rather than on an attempt to cover the world of knowledge

comprehensively (Olson & Boll, 2001). Such classifications usually consist of mixed, not mutually exclusive classes in which disciplines (e.g., Humanities), concrete subjects (e.g., Shopping), and bibliographic form or purpose (e.g., Reference) are on the same hierarchical level (Kwasnik, 2000, 2002; Bar-ilan, 2004).

In short, instances of Web classification are used to describe Web-based information systems incorporating categories. This review of the use of Web classification demonstrates that putting like information together in a Web context differs from classical categorization and classification approaches primarily in using multiple access points. Even when Web classification is implemented using existing classification schemes such as DDC and LC, the flexibility in the depth of hierarchy and the provision of multiple subject access points in the collocation of items are essential. As Kwasnik (2002) claims, Web classification presents an interesting blend of traditional approaches to classification and a creative application of the multiple access points enabled by Web technology. Web technologies also enable Web classifications to support users' browsing and resource discovery through hypertext linking. In order to facilitate subject access to Web resources, Web classification deals with categories that are overlapping and not mutually exclusive. This implies a shift of Web classification from the primary objective of "collocation of conceptually related

documents through the systematic application of a well-defined representational language" (Jacob & Priss, 1999, p.76). In other words, Web classification including folksonomy employs a broader view of classification, allowing loose structure and high flexibility. Categories might be structured by "the often-unspecified criteria of similarity" unlike traditional classification which is defined by predefined criteria (Jacob & Priss, 1999, p.75).

(3) Folksonomy

Today there is an emerging approach to classification on the Web, the folksonomy. Because the folksonomy is implemented through tags, the term 'tagging system' is often used interchangeably. However, a folksonomy needs to be clearly defined as distinctive from tagging. Tagging is a process by which users assign one or more keywords (tags) to Web resources with a purpose to share, discover, and recover them, whereas a folksonomy refers to a grassroots organizational scheme that emerges from tagging; in other words, a folksonomy is a result of user-created tags.

Two generally recognized aspects of tagging make folksonomic mechanisms highly popular and useful in Web-based information systems. First, not only authors, but anyone can produce tags. This implies that a folksonomy is able to reflect diverse viewpoints of

users who might tag the resource differently from the author or differently from each other (Weinberger, 2006). Second, tagging is social in that users are encouraged to publicly tag and share their tags and resources. Social tagging allows a certain group to form around similarities of interests and points of view. As soon as users assign a tag to a Web resource, they can see the cluster of related users and tags that are associated with the same resource. This instant feedback leads users to find other users who are interested in the same topic, and to network with them.

Tagging collectively produces a larger classification system, a folksonomy, from a bottom-up approach. A folksonomy consists of a flat space defined by the set of tags with which a group of users tagged information resources. A folksonomy can be displayed through a tag cloud (see Figure 2.2) (Golder & Huberman, 2006).

Figure 2.2 Tag Cloud

A folksonomy is an organic way of organizing information, in that categories are created in an ad hoc fashion by any user who has access to information and is part of that system (Shirky, 2005; Weinberger, 2006). Shirky (2005) describes a folksonomy as a classification constructed from a bottom-up consensus view of the world, which creates an aggregative view of users while "it grows with scale in systems with single points of view" (p.16). Since tagging is social, as it is meant to make information more retrievable and shareable, a consensus of what tags to use may form. In a broad folksonomy such as Delicious where a large number of users contribute to tagging the same item, there is likely to be overlap in the set of tags users apply (Kipp & Campbell, 2006). In their analysis of tag use, Golder and Huberman (2006) found that the tags applied to a given Web resource appear to stabilize over time. The authors speculate that this stabilization is caused by imitation and

shared knowledge. Since most folksonomic systems show users the tags most commonly used by others who bookmarked the same item, they can easily select those tags for use in their own resources. Users tend to tag the resource the popular way or imitate others' tags (Golder & Huberman, 2006). Campbell (2006) points out that a folksonomy encourages a user to "integrate his or her reflection of the resource into evolving structures: the user's own tags, those of other users, and those that are most popular" (p.9).

In the case of folksonomy, tags relate to "categories" which are associated with our cognitive conceptual models rather than "classes" which entail a rigid relationship by a set of essential characteristics. Tags usually serve as categories to group like resources together in a folksonomy. As mentioned earlier, two types of categories coexist in the folksonomy: idiosyncratic categories represented by the individual's cognitive models reflecting his or her purposes and experience; and communal categories which emerge in a social context where individuals interact with each other. The tags as categories are used to collocate resources within a user's personal collection. Additionally, the tags are also used to collocate resources across the entire system by showing all resources that are tagged with the same term by any member of the folksonomic system.

In addition, tags and folksonomies are relevant to Mooers' (2003) concepts of

descriptors and descriptor systems. He advocates “idea-element retrieval clues” called “descriptors” which are oriented to represent concepts, not terminologies (Mooers, 2003, p.814). The descriptor systems are constructed in a pragmatic way to tailor the intellectual scope of descriptors at will with lack of hierarchy (Mooers, 2003). These characteristics of descriptor systems are relevant in a folksonomic context in that the emergent structure reflects individuals’ context and purpose in a non-hierarchical way. The use of descriptors and the formation of selective specifications by combinations of descriptors (Mooers, 2003) also bear similarity to the use of tags in a folksonomy. As Mooers (2003) emphasizes, such descriptors are effective for retrieval because of the flexibility and pragmatic freedom to manipulate meaning, once a group of users and its scope of actual interest are well defined. On the other hand, descriptors are distinct from tags in that descriptors represent the explicit meaning of terms. Descriptors consist of terms which may be arbitrary for mnemonic purpose, but are well-defined for specifying the range of utilization in the retrieval system (Mooers, 2003). Because the descriptor systems are devised for effective retrieval, descriptors have one-to-one relationships between terms and concepts, whereas tags have the inherent ambiguity of natural language.

To summarize, a folksonomy presents itself as a Web classification which is generated

from a bottom-up approach with tagging. User-created tags generate two different types of categories of folksonomy: idiosyncratic categories and communal categories. Idiosyncratic categories have the great power of flexibility to reflect individuals' variant cognitive models based on their purposes and contexts. On the other hand, communal categories are generated in a social context in which individuals share their categories with each other, so that they can easily browse and retrieve the information classified by others. Communal categories foster the exchange and communication of information in the collaborative context. The review of descriptors also suggests that a folksonomy has the potential to support a well-defined group of users, who have common interests, goals, or values, to form shared semantics. Once a domain is well-defined, a folksonomy can contribute to building shared knowledge and communication. Therefore, a folksonomy is defined as a Web classification that encourages users to organize information in their own ways (idiosyncratic categories) and involves users actively in the development of a classification system (communal categories). This concept of folksonomy raises other questions about classification theories: What classification theories are useful to construct or evaluate Web classification, including a folksonomy? Can traditional classification theories and practices that were developed in the bibliographic context be transferred to the context of Web

classification, including a folksonomy, or do we need a new theory?

2.2.2 A shift in understanding classification from traditional classification to contemporary classification

This section describes a shift in understanding classification from traditional to contemporary conceptions of classification that are related to construct or evaluate a folksonomy. The review describes a shift in classification research, including theoretical foundations at the abstract level and practical contexts at the operational level, from traditional to contemporary classification. The study draws on the practical approach to folksonomy that reflects given goals, purposes, and values in order to produce a useful tool for its users and society.

(1) Abstract level – scientific classification & pragmatic classification

For decades, there has been a shift in the theoretical foundations which classification research has followed. This shift is associated with the underlying philosophical assumptions of knowledge and classification. Traditional classification seeks to represent

knowledge objectively and neutrally in a scientific way, while contemporary classification searches for the pragmatic principles that reflect the given goals of a specific domain.

In light of its theoretical foundation, traditional classification research is dominated by the positivistic and empirical approach that knowledge is acquired by observations of facts or by experience (Smiraglia, 2003). Traditional classification is tied to an objective and neutral perception that knowledge is relatively permanent, and that relationships stand more or less for all time (Mai, 2004a). Classification aims to replicate the universe of knowledge as nearly as possible. In this way, traditional classification is closely linked to a universal structure of knowledge that corresponds to the predetermined order, such as order of nature or literary warrant (Hjørland & Nicolaisen, 2005).

Traditional theorists believed that scientific methods can uncover true relationships, which in turn enables a classification system to prescribe how a set of documents should be organized and to predict the consequence of organization (Richardson, 1901/1964). This scientific tradition leads to the establishment of several scientific principles of classification. For instance, bibliographic classification encompasses historical principles, evolutionary principles, and complexity principles that follow the order of science (Ranganathan, 1967). In addition, in pursuit of an empirical account of science, traditional classification relies for

the most part on objectively verifiable criteria for classification (Mai, 2004a). This is also linked to the classical approach to categorization that categories are defined only by a set of properties that all members share.

However, there are some criticisms which have been made of positivism in classification theories and the reliance on empiricist methods of research. These criticisms point to contemporary classification research that seeks an alternative theoretical foundation for classification. Contemporary classification supports a pragmatic foundation that classification should be helpful and meaningful for its users and for society. The contemporary theoretical foundation is based on the assumptions that knowledge is constructed through social, cultural, and historical context; classification is an active construction of reality and a particular view of the world; classification is theory dependent; and classification fulfills the criterion of good values.

In terms of a theoretical foundation, contemporary classification seeks to reflect given goals, purposes and values, in order to produce a useful tool for its users and society. Contemporary classification researchers suggest domain analysis to identify the context, discourse, and activities of a specific domain for the construction of classification. This is based on the fact that there exists no neutral platform from which views may be evaluated,

so classification should reflect given theoretical views or the social and cultural context (Hjørland & Nicolaisen, 2005).

Contemporary classification research is mainly distinguished by two approaches, applying either the human interpretation oriented to study language, meaning and understanding (i.e., Mai, 1999, 2000), or an epistemological approach to classification oriented to study a theoretical and historical process (i.e., Hjørland, 1997, 2003, 2005). However, both approaches question values of classification, based on pragmatic thought (Hjørland, 1997, 2003; Mai, 2002, 2004a; Olson, 1998). From a pragmatic view, contemporary classification calls for research exploring the value of classification and the influences of particular social and cultural phenomena or historical process in organizing information. Therefore, instead of claiming to search for the truth that represents reality objectively, contemporary classification, following Rorty's conception of pragmatism, searches for the process of justification that meets the demands of the community (Rorty, 1999).

In sum, classification research has gone through a significant shift in the theoretical foundations which have followed from scientific classification to pragmatic classification. Traditional classification seeks to represent knowledge objectively and neutrally in a

scientific way, while contemporary classification searches for the pragmatic principles that reflect given goals of a specific domain. Such a difference in the theoretical foundations, in turn, leads to a difference of values and goals of classification in the construction of a classification system. In other words, a difference in the theoretical foundations points to a difference in the practical context of bibliographic classification and Web classification.

(2) Operational level – bibliographic classification and Web classification

This section outlines a shift in the practical context of classification from traditional classification to contemporary classification. Such a shift is drawn by linking to a change from bibliographic classification to Web classification. How different are the ways in which bibliographic and Web classification operate in terms of the nature of users and contexts? What are the classification theories useful to design or evaluate Web classification, including folksonomy? Can traditional classification theories be transferred to the context of Web classification, or do we need a new theory?

Bibliographic classification is used to denote classification that has been used for bibliographic purposes in libraries, such as the DDC and LCC. Bibliographic classification is designed to arrange physical information embodiments, mostly books, in a helpful order

and to place them on library shelves. Shelf arrangement characterizes bibliographic classification. Because one item should have one place and not overlap with others, bibliographic classification does not allow cross-classification, that is placing the same composite subject in more than one class (Foskett, 1969/1970; Langridge, 1976).

Due to the constraint of shelf arrangement, linearity is limiting in bibliographic classification. As Iyer (1995) points out "the major constraint of classification schemes has always been the need to arrange knowledge, which is inherently multidimensional, in a linear manner" (p.147). Bibliographic classification is restricted to assign only one class for the translation into the linear order of the library shelf (Iyer, 1995; Jacob, 2004). Bibliographic classification postulates that it is possible to accommodate all possible subjective views of the same science (Olson, 1998). However, no system represents the universe of knowledge objectively and free from perspective in its totality. Bibliographic classification depends on the view of the world of the classifiers and cannot avoid their subjective and cultural bias. Bibliographic classification tends to establish only one authoritative structure which cannot take into account the variety of users' need and views. The linearity and shelf arrangement, therefore, causes bibliographic classification to be skewed toward the mainstream (Olson, 1998).

This linearity also gives rise to the inflexibility of bibliographic classification. Bibliographic classification requires all classes to be prescriptive, and the predictions to be stable over time. Foskett (1969/1970) remarks that the inflexibility of bibliographic classification tends to crystallize the arrangement in a structure reflecting the approach to knowledge at one particular time, and to make more difficult the process of changing it. In other words, bibliographic classification systems are not responsive to the context of uses and therefore can severely constrain the individual's ability to communicate with the system in a meaningful and productive manner (Jacob, 2004).

By contrast, Web classification has the strength of flexibility and multiplicity in its structure to organize resources. In terms of organizational structure, Web classification typically uses a hierarchical structure to offer access to related subjects, as does bibliographic classification. However, Web classification allows users to move down the hierarchical structure easily and locate the item through different access points by placing it at multiple points in the hierarchical structure (Mai, 2004b). Web classification allows for cross-classification, which makes it possible to locate a given subject in more than one place within the structure (Rowley, 2000). In particular, links in the Web environment enable one to add value to cross-classification of bibliographic classification.

Web classification also pursues flexibility in the process. Web classification is creative in the way that it allows users to participate in the organization of information. In particular, a folksonomy encourages all users to contribute their own personal categories to generate a collaboratively built 'bottom-up' classification system. In this way, a folksonomy is able to provide the flexibility which reflects users' conceptual models of the world around them (Macgregor & MaCulloch, 2006). It does not rely on predetermined definitions but is able to respond to similarity assessments based on immediate context, personal goals, or individual experience (Jacob, 2004).

In sum, there exist essential distinctions between bibliographic classification and Web classification, in terms of the nature of users and their contexts. Bibliographic classification is tied to shelf arrangement in libraries, so classes are predefined and fixed. In contrast, Web classification is responsive to the dynamic context and users. Web classification seeks to provide flexibility and variability in its structure to organize resources where users can interact actively with a classification system in the Web environment. These differences lead us to rethink the theories of bibliographic classification in adapting to the Web environment, seeking a new theory which can deal with the variety and flexibility of categories. We also have to take into consideration the nature of the Web environment in

which the user can navigate easily and access documents directly. More importantly, the scientific theories of bibliographic classification, which have primarily dealt with scientific or scholarly material, are not appropriate to organize Web resources (Mai, 2004b). As Mai (2004b) points out, we need to move the focus towards classification based on needs and uses of the information, which points to the pragmatic principles of classification and folksonomy. Therefore, a folksonomy as classification should be understood in a pragmatic way which reflects given goals, purposes and values, in order to produce a useful tool for its users and society. Especially, a changing information environment requires a folksonomy to be responsive to the dynamic context and users of the Web. To respect this, it is necessary to further study how a folksonomy reflects an interaction among users, a domain, and a classification structure.

2.3.3 Conceptualization of folksonomies as a reflective and interactive Web classification

The review of classification theories provides the conceptualization of folksonomy which serves as a Web classification that allows users to participate in the development of a classification system and interact within a system. A folksonomy has advantages as a reflective Web classification system. First, a folksonomy can directly reflect the vocabulary

of users in the classification system (Mathes, 2004). The strength of a folksonomy is the ability of any given user to describe the world as he or she sees it (Guy &Tonkin, 2006). Unlike traditional classification systems developed by highly trained information professionals, folksonomies are generated by users who participate and contribute their own tags to generate a folksonomy which more accurately reflects their conceptual model of the world around them (Macgregor & McCulloch, 2006). A folksonomy, thus, is able to reflect the variety of category definitions and the corresponding variability of category memberships as a reflection of immediate context. It allows for disparate opinions and the display of multicultural views because through personal tags idiosyncratic views can co-exist and thrive in the form of idiosyncratic categories in the folksonomy. A folksonomy, therefore, has the potential to discover the variety of users' needs and views without cultural, social, or political bias.

More importantly, a folksonomy has the strength of sharing tags and resources which provides additional public values. There exists a network among users, Web resource, and tags in a folksonomy (Cattuto, 2006; Damme, Heoo, & Siorpaes, 2007). A user creates the association between tags and resources by assigning tags to that resource; each tag serves as a link to additional resources tagged the same way by others. As a result, users are

indirectly linked with others by sharing the same tags and/or resources. Through this complex network among shared tags, resources, and users, a folksonomy offers the opportunity for users to more easily get to know others who have similar interests, and to learn of others' resources. In this way, users can find other users that work on related topics, and resources associated with the tags and users. This implies the potential of a folksonomy to generate a domain of users who share their interests. In folksonomy practices, some systems, including Bibsonomy[2], Flickr[3], and Connotea[4], provide the ability to join one or more user groups. In this way, users with similar interests can share their tags and resources. Further, this social aspect of a folksonomic system fosters the building of communal categories which reflect knowledge of a domain.

Additionally, a folksonomy supports findability of related resources when a user browses resources classified by others. A folksonomy provides related information through electronic methods such as the use of co-occurrence of categories and hyperlinks. This is not the same as the semantic relationships which traditional classification systems employ, but users are able to browse related tags and users through the folksonomic system.

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[2] http://www.bibsonomy.org/
[3] http://www.flickr.com/
[4] http://www.connotea.org/

Folksonomy users also find other tags in the system with a close correspondence to the currently suggested tags. In particular, a tag cloud which provides popular tags serves as an effective navigational tool for finding resources tagged with similar concepts (Kroski, 2005).

These characteristics of folksonomies provide a means to construct or evaluate a Web classification which accounts for the interaction among users, a system, and a given domain. A folksonomy allows users to participate and contribute their own personal tags to generate a folksonomy; thus, a folksonomy can more accurately reflect users' conceptual models of the information around them. In addition, a folksonomy fosters the formation of a domain that consists of a group of users who share interests through shared tags and resources. It leads to production of a shared classification structure which reflects given goals, purposes and values of a domain. Lastly, a folksonomy supports users' browsing and serendipitous discovery of related information through the interlinked system of tags.

The review of classification theories leads to our conceptualization of folksonomy as a reflective and interactive Web classification. In order to fully exploit this conception and support it, further empirical study is necessary to understand users' interactions with a folksonomy. Therefore, this study adapts an information foraging approach in order to

better frame how the folksonomy is structured through users' interaction. It points to the review of the second dimension of a folksonomy as information scent which addresses how to identify users' interaction with a folksonomy.

2.3 Folksonomy as information scent: The literature of Web interaction and user study

The literature of Web interaction and user study offers us a research framework to explore folksonomy as information scent and to understand users' interactions with a folksonomy. This review addresses: (1) information foraging and scent theory, considering (2) our approach to understand users' folksonomic interaction. Finally, the review draws (3) an exploratory model to study users' interaction with a folksonomy.

2.3.1 Information foraging theory to understand users' interaction with the Web

This section reviews what information foraging and scent theory is, and how this theory is used as a framework from which to study Web interaction. This review discusses the use of information foraging and information scent theory in general, and especially the measurement of information scent in order to understand users' interaction with the Web.

(1) Information foraging and scent theory

In the early 1990s, Pirolli and Card proposed information foraging theory as an approach to understanding human information-gathering and sense-making strategies. Information foraging is a theory based on optimal foraging theory with the assumption that, when searching, people utilize a foraging mechanism which evolved to help our animal ancestors find food (Chi et al, 2001; Jacoby, 2005; Pirolli, Fu, Chi, & Farahat, 2005). Linking the similarities between people's information seeking patterns and animal food foraging strategies, information foraging theory claims that when feasible, information seekers modify their strategies or the structure of the environment to maximize the rate at which they gain valuable information (Pirolli & Card, 1995).

In this conceptualization, information essentially has a scent; just as animals rely on local smell cues to make judgments about where to go next in pursing some prey, when people navigate the Web, they pick up the scent of the information they are searching for (Pirolli & Card, 1995). Information scent is defined as a user's perception of the value and cost of accessing a piece of information based on the perceptual cues available to him or her. This analogy of information scent accounts for the fact that users must rely on terse

representation of content to determine the value of information in relation to their information goal.

Further, Pirolli and Card (1995, 1999) examine human interaction with information retrieval and Web systems based on information foraging theory. With empirical studies, they claim that users constantly weigh the potential information gained against the costs of performing a task necessary to find information, in a rich information environment. Users construct effective foraging patterns, through continuously adapting decision-making and direction to the ever-changing environment. Pirolli (1997) remarks that information foraging as an adaptive approach employs "the analysis of human-computer interaction and the synthesis of new designs for interaction" (p.3).

In the context of information foraging, information scent is used to explain and predict users' Web navigation patterns. Users assess the profitability of an information source in relation to other alternative sources (Pirolli & Card, 1999; Spink & Cole, 2006). In the Web navigation context, users follow the strongest scent for their desired information. And, if they somehow lose the scent (often by following a link that doesn't lead where they think it will), they have to loop back to pick up the scent all over again (Koman, 1998). Thereby, information scent plays an important role in guiding users to the information they

seek as well as in providing users with an overall sense of the contents of collections.

There are a considerable number of studies that adapt information foraging and scent theory in order to explain complex Web information seeking behaviors (e.g., Choo & Turnbull, 2000; Chi et al., 2001; Chi & Pitkow, 2000; Kalbach, 2000; Pirolli, & Card, 1995). In particular, Choo and Turnbull (2000) present a behavioral model of Web information seeking, using information foraging and scent theory. Based on observations and interviews with 34 users, their study develops a framework which characterizes Web information seeking behavior. The model developed by Choo and Turnbull indicates the common patterns of Web behavior, integrating the existing information retrieval models and information foraging and scent theory. The model consists of two axes; on one axis of the model, episodes are plotted according to the four scanning modes identified by Aguilar (1967) and Weick and Daft (1983): undirected viewing, conditioned viewing, informal search, and formal search. On the other axis, episodes are plotted according to the six categories of information seeking behaviors of Ellis (1989): starting, chaining, browsing, differentiating, monitoring, and extracting (Choo & Turnbull, 2000). Their model accounts for a holistic understanding of Web information seeking behaviors, by regarding information foraging and scent as *a priori* to Web information seeking behavior.

In a similar approach, Kalbach (2000) presents the rationale for creating information finding mechanisms based on information foraging theory. He draws potential design features for information foraging from within the framework of Choo and Turnbull (2000). In this study, information foraging and scent theory allows the researcher to analyze Web information behaviors and generalize their elements as a guiding framework to present applicable feature for system design.

In sum, information foraging and scent theory is a holistic information seeking model that reflects some of the problems posed by the general task faced by Web users as well as the structure and constraints of the information environment of the Web (Wang, Hawk, & Tenopir, 2000). Information foraging and scent theory present us with a good understanding of Web information seeking behavior in general, integrating a theoretical framework and practical guidelines for the design of systems on the Web. By suggesting that people utilize a foraging mechanism in order to optimize their search outcomes, information foraging and scent theory give us a theoretical perspective with which to interpret and understand Web information seeking behaviors. In other words, we can understand folksonomic interactions in terms of the way that people constantly weigh information scent to improve their interaction with a folksonomy. This raises the questions:

How can we identify information scent in the folksonomic interaction? How can we apply information foraging and scent theory to study a particular context, namely folksonomic interaction? This leads us to the review of empirical studies that have explored information scent within a methodological framework.

(2) Empirical model to understand users' interaction

As described previously, information foraging theory assumes that people choose information seeking strategies that optimize the utility of information gained in relation to the cost of interaction (Pirolli & Card, 1999). The perceived relevance of the environmental cues in judging information sources and navigating through information spaces is measured by information scent (Fu & Pirolli, 2007). The measure of information scent, therefore, provides a means to predict how users will evaluate different links on a Web page, and as a consequence, the likelihood that a particular link will be followed (Fu & Pirolli, 2007). A number of empirical studies have been conducted to explore information foraging and scent theory by PARC (Palo Alto Research Center) researchers (i.e., Fu & Pirolli, 2007; Pirolli & Fu, 2003; Pirolli, Fu, Chi, & Farahat, 2005).

Information foraging theory has been developed within the framework of

methodological models which explore the information scent which is involved in link choice as well as site-leaving (Fu & Pirolli, 2007). Using a tracing technology, these models enable us to predict where the user will navigate, and what information resources he or she will select based on the analysis of information need. We can also examine link-following behaviors of users through information scent which suggests that users working on unfamiliar tasks will choose links that have high information scent; on the other hand, the user will leave the Web site when the expected utility of the site, namely information scent, diminishes below the utility of moving to another site (Pirolli & Fu, 2003).

Recently, the SNIF-ACT (Scent-based Navigation and Information Foraging in the ACT Cognitive architecture) model was developed to explain users' interaction with the Web when users are engaged in unfamiliar information seeking tasks (Fu & Pirolli, 2007; Pirolli & Fu, 2003). Several empirical studies present a user tracing method to investigate users' interaction with the Web: controlled laboratory experiments are conducted using tasks derived from a task database collected by a survey of Web users; the laboratory experiments collect data using an eye tracker, logging software collects all user interactions with a Web browser, and video recordings are made of think-aloud verbal protocols; and these data are coded by automatic means and by hand into a comprehensive trace of states

and events representing the interaction of the user with the Web (Pirolli & Fu, 2003).

Empirical studies provide strong support for the use of information scent to characterize information foraging behavior (Pirolli, Fu, Chi, & Farahat, 2005). The general findings from these studies tell us that models developed in this theory of information scent can:

- predict where people will navigate or what information resources they will select based on their information need;
- infer what information need they have, given observations of their navigation or information selections; and
- infer the category structure that people will induce from interaction with an information system (Pirolli, 2002).

In sum, most of the existing studies which explore information scent in users' interaction with the Web are directed toward measuring information scent with established methodological strategies. Their empirical results demonstrate that information scent can be measured systematically, and such measurement can generate good predictions of Web interaction. However, this measurement of scent is not likely to help understand users' interactions fully. Behavioral measures such as click-throughs and log analysis merely tell

us what works and what does not. They cannot lend insight into user perceptions of information scent, in other words, how they assess the environmental cues in judging information sources and navigating through information spaces. A small number of studies have explored information scent from a perceptual approach. They examine the quality of the cues and the cognitive heuristics that users' perception might trigger (Sunder, Knobloch-Westerwick, & Hastall, 2007). However, more research is necessary to explore users' perception and awareness of information scent in order to better understand users' interaction with the Web. In particular, a folksonomy is a relatively new information structure and folksonomic interaction is little known. How do users interact with a folksonomy in accessing, sharing and navigating Web resources? And in what ways can we explore information scent in a folksonomy, which facilitates users' information foraging behavior? To address these questions, we will consider a qualitative approach to folksonomic interaction that is open to our awareness and perception.

2.3.2 Approaches to understand users' folksonomic interaction

This section addresses how the study will approach an understanding of users'

interaction with a folksonomy. The review focuses on folksonomic studies, which attempt to explore the phenomena of social tagging to date, and qualitative studies, which identify the process of categorization and representation in the library context.

(1) Folksonomy studies

The past two years have seen a considerable increase in the number of studies in LIS that explore the use of folksonomy, especially focusing on the formulation and distribution of tags (see Table 2.1 Summary of Folksonomy Study). Most of these studies focus on how people formulate the tags and folksonomy, and identify the pattern of tags used in a folksonomy, based on tag analysis. As Table 2.1 indicates, a number of studies that explore the use of folksonomy rely on an investigation of tag frequency to approach a folksonomic interaction (i.e., Fokker, Pouwelse, & Buitine, 2006; Golder & Huberman, 2006; Guy & Tonkin, 2006; Kipp, 2007; Kipp & Campbell, 2006; Lin, Beaudoin, Bui, & Desai, 2007; Marlow, Naaman, Boyd, & Davis, 2006; Tonkin, 2006b; Voss, 2006).

This yields a one-sided understanding of a folksonomic interaction, drawn from the primarily quantitative aspects of a folksonomy including the distribution and pattern of tags. A quantitative approach does not yield any understanding of how users actually assign, use,

and share tags in structuring a folksonomy. As Mathes (2004) points out, “examining user behavior through ethnographic observation or interview to understand user motivation and cognitive processes in tagging items” (p.17) is necessary to fully understand a folksonomic interaction.

From a qualitative approach, we can clarify the other side of a folksonomic interaction, in other words, users’ perceptions and motivations. In particular, interviews enable the researcher to identify what factors directly influence the formation of a folksonomy, and how the motivation of group communication influences users’ interaction with a folksonomy (Mathes, 2004).

Table 2.1 Summary of Folksonomy Studies

	Description of study	Folksonomic system	Data analysis	Data collection period
Fokker, Pouwelse, & Buitine (2006)	Comparative study of Flickr & Wikepedia (the nature of tags)	Flickr Wikepedia	Tag analysis (Ambiguity, Synonyms)	Dec. 2005
Golder & Huberman (2006)	Tag usage pattern	Delicious	Tag frequency Regularities in user activity Types of tags Bursts of popularity in bookmarking	June 23-27, 2005
Guy & Tonkin (2006)	Tag usage pattern (Power law) Tag literacy	Delicious Flickr	Tag popularity Tag distribution	N.R.
Kipp (2007)	Types of tag (non-subject tags)	CiteULike Connnotea Delicious	Tag analysis (Types of tags:Time, task, emotion related tags)	Oct. 20-31, 2006
Kipp & Campbell (2006)	Tag usage pattern	Delicious	Frequency of tags # of unique tags # of users with a specific tag for each URL Count of the total # of tags & total # of unique tags for each URL	Jan. 30-31, 2006
Lin, Beaudoin, Bui, & Desai (2007)	Nature of tagging	Connotea Flickr Delicious	Connotea: Similarity between tags & MeSH Flickr: category assignment for the user tags Delicious: Convergence of tags	N.R.
Marlow, Naaman, Boyd, & Davis (2006)	Tag usage pattern	Flickr	Usage correlation Distribution of tags Overlap of tag distribution for random users & contracts	N.R.
Sinclair & Cardew-Hall (2008)	Users' perceptions & usage patterns of interface design (Tag cloud)	Folksonomy-like system designed for experiment study	Experiments & survey (Task-based evaluations w/ 89 participants)	Aug. 17, 2008-May 25, 2006
Trevino (2006)	Users' perceptions on the information on Delicious & the implications of the site's structure	Delicious	User interviews (w/ 16 participants) Content analysis	Feb.-March, 2006
Voss (2006)	Nature of tagging (Comparison of structural properties among tags thesauri, & DDC)	Delicious Wikipedia	Descriptors per record Records per descriptor Descriptor levels	N.R.

Trevino (2006) provides an interesting analysis of the users' perceptions of the information they organized and the implications of Delicious' structure. She conducted face-to-face interviews with 16 participants asking their browsing activities, history of using Delicious, interactions with others on or about Delicious, general opinions or questions about Delicious and other users, and performed a content analysis of their comments. Her study identified the tensions between using Delicious for the purpose of a personal information archive and for public discovery, as well as those between personal privacy and the social norms of openness among users. While her study provides an important analysis of users' understanding and motivations of using Delicious, this study is limited in that she examined only one system for a period of one month. The results are an important first step in the analysis of users' understanding and usage of a folksonomic system from a qualitative approach. However, the study focuses more on how people generally understand and use Delicious, rather than their actual activities of tagging or use of tags. It is important to examine the cognitive and behavioral aspects of folksonomy uses. What is the tagging behavior of people who use folksonomies? Why do people choose the tags they use; what motivations lead them to modify these tags; how do others' tags and tagging behaviors affect their tag decision? Until we understand more about the users'

tagging behaviors, how they assign, use, and share the tags and their resources, it is difficult to understand fully their folksonomic interactions.

In addition, folksonomy studies to date have usually presented preliminary work which is limited to discussing issues involved with users' tagging activity and suggesting an agenda for further research. Despite increasing attention in academic research, little empirical research has been done to build a conceptual model in order to understand users' interactions with a folksonomy. In discussing folksonomy research, Macgregor and McCulloch (2006) point out the lack of a theoretical framework. They note that "[the] lack of conceptual progress has consequently manifested itself in a lack of testable conceptual models and empirical studies" (Macgregor & McCulloch, 2006, p.299). Therefore, our approach to study the structure of folksonomy should be based on a solid conceptual model from a qualitative approach to better understand users' interaction with a folksonomy.

(2) Qualitative approaches to understanding of the process of categorization and representation

Qualitative research methodology is useful in understanding how individuals' perception and intentions in situations determine their behavior, and how they understand

their world (Krathwohl, 1997). In the context of investigating information systems, qualitative research is usually oriented to understanding the context of the information system, and the process whereby the information system influences and is influenced by the context (Myers, 1997). In this section, three studies are reviewed which investigate the process of categorization and representation in the library context where trained professionals usually determine the subject of a given document using classification, catalogs, and subject headings. Each study attempts to understand the activities and issues associated with the process of categorization and representation, including subject cataloging, subject analysis, and indexing from qualitative approaches. Because this review aims to build an empirical model for the current study, it focuses on research processes and techniques involved in qualitative approaches to understanding of the context of categorization and representation in the practices of organizing information.

Endres-Niggemeyer (1998, 2000) provides a cognitive model of summarization, namely SimSum (Simulation of Summarization). This model aims to simulate natural human strategies of summarizing and produce a computational cognitive model of the process (Endres-Niggemeyer, 2000). With empirical modeling using methods of grounded theory development, SimSum simulates 20 real working steps of experts. Six expert

abstractors and indexers at work performed think-aloud protocols for their summarizing processes. The summarizing process and strategies were analyzed by identifying working steps of abstracting, indexing and classifying. The research produced a model of the summarizing process which analyzed the working steps and put them in sequence (Endres-Niggemeyer, 2000).

The key idea underlying this model is the method of grounded theory development, which assumes that it is possible to ground a summarization system on observables of human expert summarization. Taking the grounded theory as a theoretical framework, the researcher formulated inductive concepts from the observed data, i.e., strategies of six experts' working steps (Endres-Niggemeyer, 1998). This study suffices to provide an explanatory model of how users perform summarization; however, it is problematic to generalize the findings from observations with only six sample participants. It is questionable whether six participants, including indexers and abstracters, are representative of human expert summarization.

In a similar study, Sauperl (1999) presents a model of the human subject determination process during the cataloguing process. The model aims to represent how cataloguers decide on the topic of a document and create an appropriate subject description.

For this study, Sauperl observed the cataloguing processes of 12 experienced cataloguers by using a think-aloud method and a time-line interview. From the narrative accounts of the twelve observations, stages of the general process of subject cataloging were identified and led to production of a model. This study provides detailed insight into the situations and real-world working process of subject cataloging. However, this model seems to be merely descriptive since it does not present a theoretical framework to inform any of the processes observed (Joudrey, 2005). It needs a theoretical foundation to explain and test a grounded model from empirical observations.

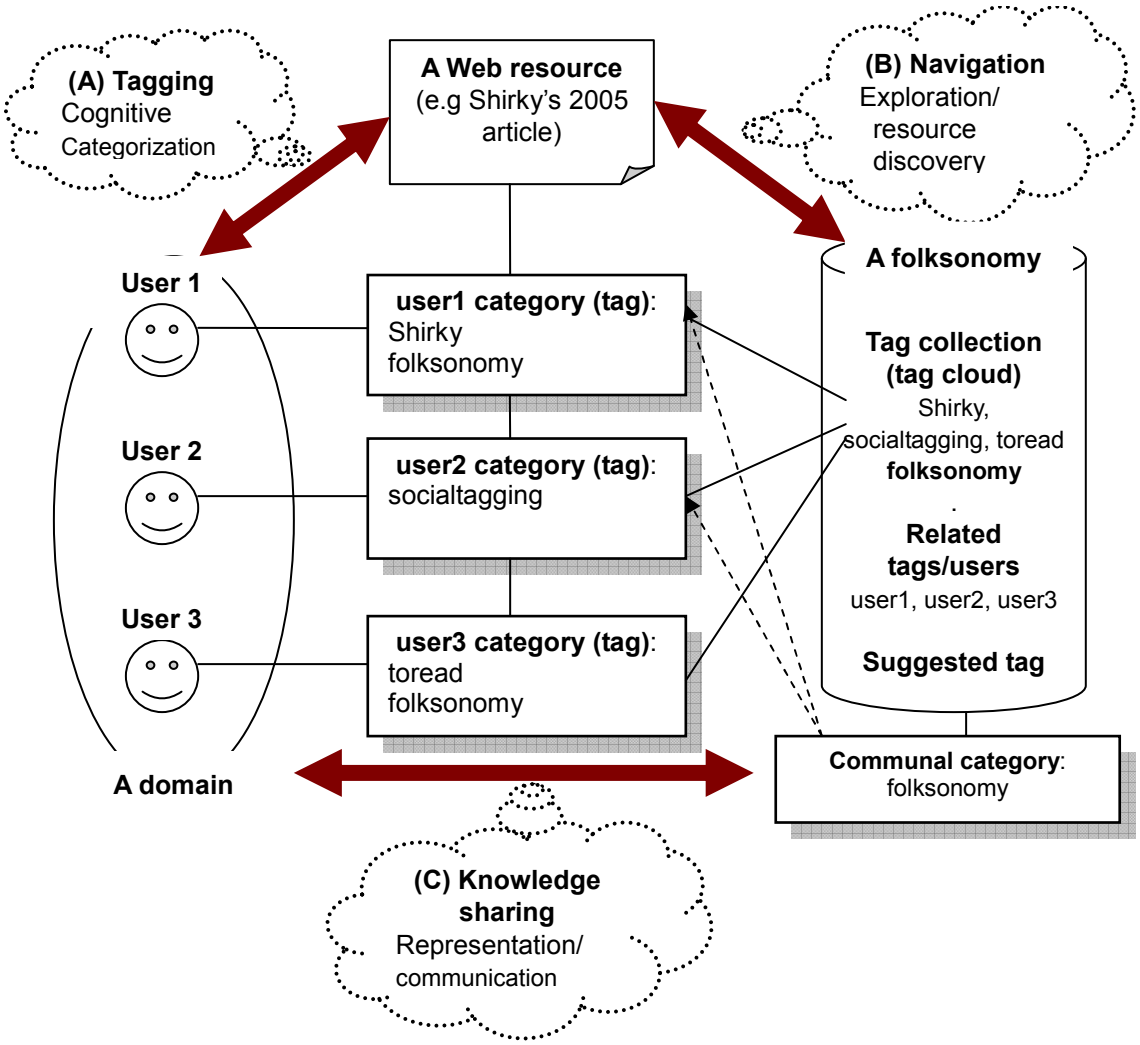
A recent dissertation, which conducted a qualitative exploration of how aboutness is determined (Joudrey, 2005), investigated conceptual analysis in the subject analysis process. Based on a structure similar to that of the study by Sauperl (1999), this study examines how interested yet untrained participants perform the task of conceptual analysis when no process is suggested. It employs observation, a think-aloud method, and in-depth, semi-structured interviews with 12 participants, identifying the patterns in their processes: the important textual and visual cues to aboutness, and the bibliographic features used to understand aboutness. This study also brings possible limitations from the participants being studied, typical of qualitative empirical studies.

In summary, these empirical studies, which employed qualitative research methods to investigate the process of categorization and representation in the library context, including subject cataloging, subject analysis, and indexing, give us considerable knowledge about conducting qualitative research on classification processes. Qualitative research is appropriate for exploratory and descriptive research questions, and is, therefore, well suited for the current study which attempts to investigate little-known phenomena involved with the tagging behaviors of users engaged in folksonomic interaction. Data collection and analysis incorporating interviews and observation will allow us to identify users' perception and intentions which determine their tagging behaviors and folksonomic interaction, and their understanding of the folksonomy which they work with in organizing Web resources.

3 CONCEPTUAL FRAMEWORK TO STUDY FOLKSONOMIC INTERACTION

This study has examined two dimensions of folksonomies, that is, folksonomies as Web classification and as information scent, in order to build our conceptual framework to study a folksonomy which reflects the interaction among users, a given domain, and a classification system. As a result, the literature review lends us insights into design of an empirical study to explore the structure of folksonomy shaped by users' interaction with a folksonomy. Figure 3.1 below illustrates a folksonomic interaction among users, a folksonomy system, and a given domain that consists of a group of users who share the same interests or goals. It points to three components of a folksonomic interaction from an end user's view: (A) tagging - cognitive categorization and representation of an individual user with a Web resource; (B) navigation – exploration and discovery of a Web resource in the folksonomic system; and (C) knowledge sharing - representation and communication of knowledge within a domain.

Figure 3.1 Folksonomic Interaction



When an individual user accesses a Web resource and classifies it by assigning tags or categories, the first interaction, *(A) tagging - cognitive categorization* occurs. For example, *user 1* assigns two *tags 'Shirky'* and *'folksonomy'* to Shirky's 2005 article "ontology is overrated: categories, links, and tags". Using these tags, he classifies the article in his idiosyncratic categories 'Shirky' with other articles he perceives as similar such as articles

by the same author and ‘folksonomy’ on the same topic of folksonomies. These idiosyncratic categories are only meaningful to user 1’s interaction with Shirky’s article. However, once these idiosyncratic categories become public and are shared with others, they become an interactive part of the folksonomy.

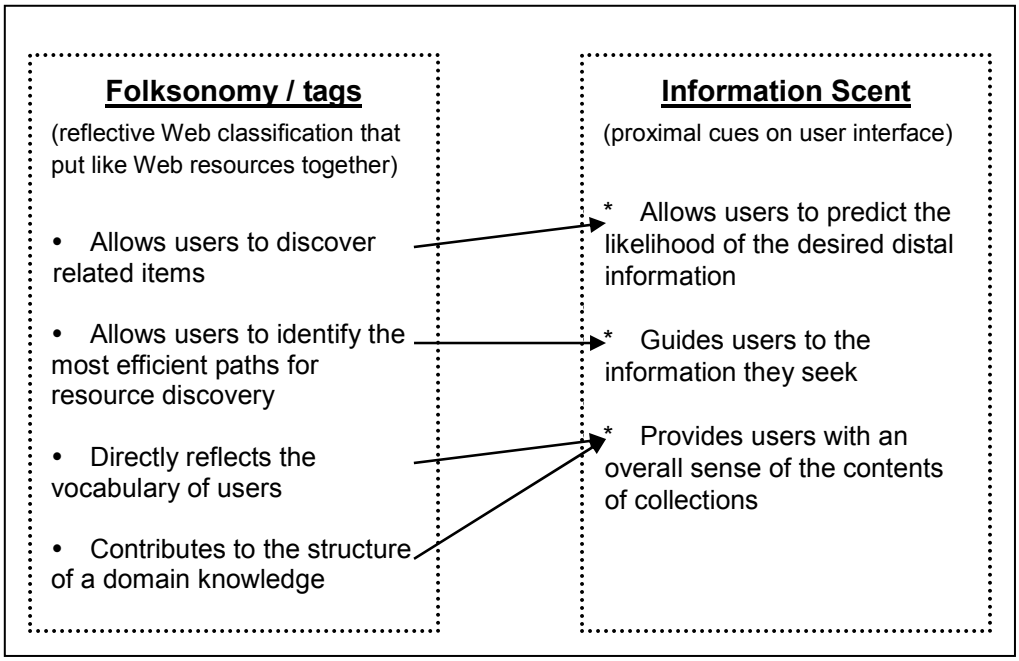
User 1’s idiosyncratic categories ‘Shirky’ and ‘folksonomy’ aggregate *a folksonomy* that consists of other users’ idiosyncratic categories for Shirky’s article such as ‘socialtagging’, ‘toread’ and ‘folksonomy’. The folksonomic system provides users with various forms of the aggregated tags of all users for that article. The system shows that ‘folksonomy’ is the most popular tag associated with this article through the use of a *tag cloud.* The system also provides users instant feedback showing ‘*Related Users and Tags’* and *‘Suggested Tag’* which are associated with Shirky’s article. These are all related to a *communal category* that may influence users to add and/or modify their idiosyncratic categories. For example, through the tag cloud or suggested tag user 2 possibly discovers that ‘folksonomy’ is better than ‘socialtagging’ to represent the topic of this article in order to communicate with other users. And consequently, he may add it or modify his category ‘socialtagging’ to ‘folksonomy’. In this context, the category ‘folksonomy’ becomes a communal category which is generated in a context where users interact with each other.

Through shared communal categories, a folksonomy supports users' (B) *navigation – exploration and resource discovery.*

In addition, while observing others' categories and sharing resources, a user group or domain which has the same interests, goals, or tasks may be established. For example, users 1, 2, and 3 can build a specific *domain* that is interested in sharing and communicating their knowledge on the topic of folksonomy through the folksonomic system. Here occurs an instance of *(C) knowledge sharing- representation and communication* in which the folksonomy works as a representational tool for a given domain. The folksonomy has grown up around a given domain of users who want to share their knowledge, creating a widely agreed upon classification.

Taking information foraging and scent theory as the theoretical framework, Figure 3.2 depicts how a folksonomy and tags are able to function as information scent. Through shared tags, folksonomies are able to provide users with a distinct information scent that leads to groups of Web resources in relation to the information they are searching for, by grouping related resources together. Based on information foraging and scent theory, this study will investigate whether and how people are aware of the role of tags as information scent that helps users to predict which resources will be pursued.

Figure 3.2 Folksonomy and Tags as Information Scent



Among the three components of folksonomic interactions identified in Figure 3.1, the current study is an attempt to better understand (A) *tagging – cognitive categorization* and its relation with other components of folksonomic interaction. The study will identify how folksonomy users are tagging in order to utilize a folksonomy in the practice of organizing Web resources, and whether and how folksonomy users are engaged with the interactions with a folksonomy through tagging. In terms of information scent, the study will explore the interactive aspects of tagging behavior, examining the use of tags as information scent. Figure 3.3 outlines the conceptual model of this study to explore tagging behaviors of users

engaged in folksonomic interactions. In this model, users basically refers to taggers who assign, use, and share tags in using a folksonomic system. Tagging is a component of users' folksonomic interactions which structures a folksonomy, and is interlinked with other components of interactions, navigation and knowledge sharing, through shared tags. To identify this connection, the study will look at the use of tags as information scent which link resources and users to each other. Using a qualitative interview and diary studies, this study will ask for users' perception and use of tags in the practice of organizing Web resources in the folksonomic system. Figure 3.4 depicts users' tagging activities associated with assigning, using, and sharing tags in the folksonomic system. This conceptual framework for exploring a folksonomic interaction with three components will link to the formulation of the research questions and methodological design for the current study.

Figure 3.3 Our Conceptual Model to Understand Tagging Behaviors

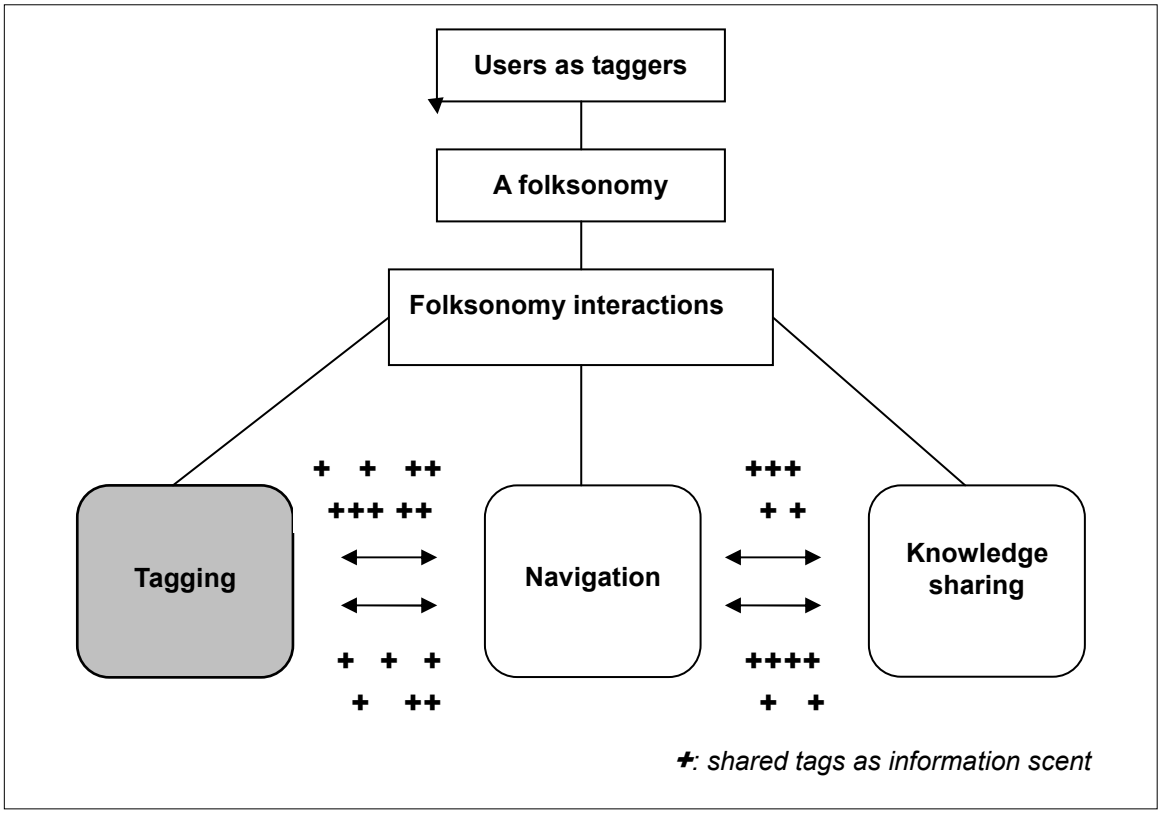
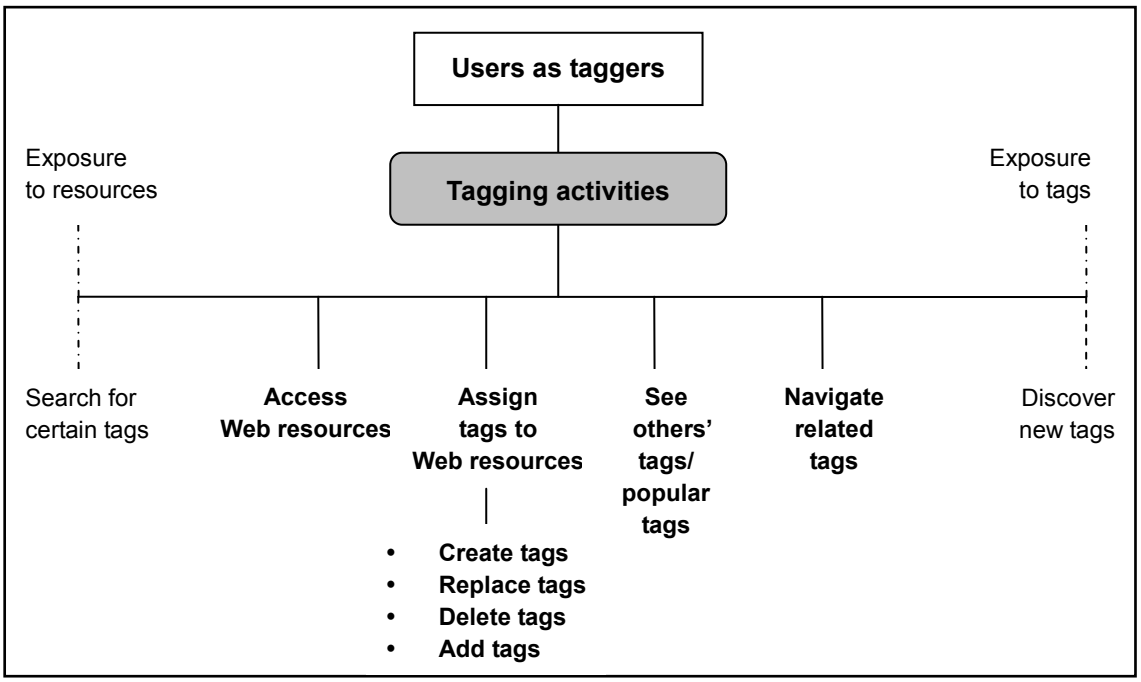


Figure 3.4 Tagging Activities



4 METHODOLOGY AND RESEARCH DESIGN

4.1 Research questions

This study explores how people are tagging in order to utilize a folksonomy in the practice of organizing Web resources. It is exploratory and descriptive, focusing on the users' tagging behaviors as they are engaged in the folksonomic interactions. The study builds upon the idea that a folksonomy is structured through interactions among users, a domain, and a folksonomic system. The folksonomic interaction includes (A) tagging, that is, an act of cognitive categorization; (B) navigation, or exploration and resource discovery; and (C) knowledge sharing, the representation and communication of knowledge within a domain. The current study proposes an exploratory model to understand users' interactions with a folksonomy. Through empirical study, this study focuses on the first components of users' interaction with a folksonomy, their tagging behaviors. This study explores the tagging behaviors of users who are registered in three folksonomic systems, which are Connotea (www.connotea.org), Delicious (http://del.icio.us), and CiteULike (www.citeullike.org).

The following are the research questions that are explored in this study:

1. How do participants tag a resource using a folksonomic system? What activities

are involved in the tagging process?

2. What are the motivations behind participants' tagging activities? How do they relate their tagging motivations to their tag decision?
3. How do participants understand the social and interactive aspects of tagging? To what extent do they consider others' tags and tagging behaviors during tagging?

These questions are addressed by the description and analysis of participants' tagging activities associated with folksonomic interactions through Web questionnaires, qualitative diary studies, and follow-up interviews with participants. The first research question explores how individuals tag a resource in using the folksonomic systems. This examination of the tagging processes of participants entails a detailed description of tagging processes, including the series of tagging activities involved, types of tags they use, and feature of folksonomic systems they use. The answers to this research question will strength our understanding of tagging practices.

The second research question examines the motivations of participants behind their tagging activities: how individuals relate their tagging motivations to their tagging activities. This examination considers what participants' motivations for tagging are, and how these motivations guide their tag decision. The answers to this research question will help us

better understand why individuals choose the tag they use in tagging.

The third research question examines the social and interactive aspects of tagging that participants perceive. The study examines how individuals understand the social and interactive aspects of tagging, and how their perceptions affect their tagging activities. By looking at the social and interactive aspects of tagging, the study will help us better understand how individuals interact with a folksonomy through tagging. The answers to this research question will also provide some insights on the role of tag as information scent.

4.2 Epistemic stance

This study approaches the usage and understanding of a folksonomy from a reflective empirical perspective (Alvesson & Sköldberg, 2000), which relates to a pragmatic understanding of epistemology. Since the research questions of the current study are exploratory and descriptive, it adopts a qualitative approach to explore how people utilize a folksonomy as a classification in accessing, sharing, and navigating Web resources. We pursue qualitative research as "a point of view for understanding the perceived reality underlying individual and social behavior" (Krathwohl, 1997, p.235) in our study.

In particular, this study seeks to use a reflective empirical approach described by

Alvesson and Sköldberg (2000):

> Empirical research in a reflective mode starts from a sceptical approach to what appear at a superficial glance as unproblematic replicas of the way reality functions, while at the same time maintaining the belief that the study of suitable (well-thought-out) excerpts from this reality can provide an important basis for a generation of knowledge that opens up rather than closes, and furnishes opportunities for understanding rather than establishes 'truths'. (p.5, emphasis in original)

Such explorations are well suited to provide "a better interaction between philosophical-theoretical ideas and empirical-practical sources of inspiration" (Alvesson & Sköldberg, 2000, p.7). This fits within the objective of our study, that is to draw theoretical and empirical insights into a folksonomy as a reflective and interactive Web classification based on the empirical results. With a reflective empirical approach, we map our theoretical ideas of a folksonomy as a Web classification that reflects interactions among users, a domain, and a folksonomic system to the empirically oriented data.

This reflective empirical research is built on a pragmatic understanding of epistemology. In particular, our study follows Rorty's pragmatic claims (1999) that emphasize 'correspondence to reality' instead of 'truth'. He states "truth is not the sort of thing one should expect to have a philosophically interesting theory about", and "[it is] just the name of a property which all true statements share" (Rorty, 1982). In this way,

pragmatists search for the process of justification which meets the demands of the community in which the researcher engages, rather than the truth that represents reality objectively.

In terms of the epistemological demand of pragmatism, Rorty (1999) goes on to claim:

> We should view inquiry as a way of using reality. So the relation between our truth claims and the rest of the world is causal rather than representational. It causes us to hold beliefs, and we continue to hold the beliefs which prove to be reliable guides to getting what we want. (p.33)

Therefore, as a pragmatic perspective, the study pursues creating useful knowledge for the community who are interested in a folksonomy or Web classification. Through empirical investigation, this study will provide useful insights into the development and evaluation of folksonomies with reflection on how people perceive and use a folksonomy as a Web classification.

4.3 Operational definitions

This section addresses the use of terminology in this study.

Bookmark: In this study, a bookmark refers to a Web resource which has been saved in an

individual's personal library in a folksonomic system. 'Bookmark' is interchangeably used with the term 'reference' (Connotea) or 'article' (CiteULike).

Categorization: the fundamental thought processes in the human mind. We use this term to address the most natural way to organize information by which our ideas and objects are recognized, differentiated and understood.

Classification: the putting together of like things. It is used to address both the concepts of classification as process and the concept of classification as a product. This study acknowledges the distinction between the two by referring to the former as *classifying* and to the latter as a *classification system*.

Communal category: one kind of category among those which comprise a folksonomy, which is the opposite of *idiosyncratic category*. In this study, it is assumed that communal categories are generated in a social context in which individuals share, retrieve, and communicate their idiosyncratic categories with each other.

Domain: a given group of users who share interests, goals, or values. A domain forms a shared classification system which reflects its norms and knowledge.

Folksonomic system: a Web-based information system for Internet users to save links to Web pages that they want to remember and/or share by adding tags (e.g., Connotea, Delicious, Flickr, CiteULike, Amazon product tagging). 'Folksonomic system' is interchangeably used with the term 'social tagging system' or 'social bookmarking system'.

Folksonomy: the collection of tags resulting from the tagging process. This study seeks to address a folksonomy as a Web classification that is generated by users with an emergent categorical structure.

Idiosyncratic category: one kind of category among those which comprise a folksonomy, which reflects an individual's own conceptual models. It is the opposite of *communal category*.

Information scent: a user's perception of the value and cost of accessing a piece of

information based on the perceptual cues available to him or her.

Navigation: moving sequentially around the system, deciding at each step where to go. In this study of folksonomy, we see tags as means to facilitate navigation. They guide a user to access relevant resources in the folksonomic system.

Personal library: an individual's collections of saved bookmarks in a folksonomic system.

Tag: used to address both the concept of tag as a product, which means a keyword which people assign to Web resources with a purpose to share, discover, and recover them, and as a process, which means the tagging behavior of creating tags. In terms of product, this study seeks to address that tags of a folksonomy act as categories that group like things together as well as a primary navigation tool for finding similar resources and people.

Tag cloud: a visual depiction of content tags used on a website; a collection of the popular tags which folksonomic systems provide as a navigation tool. The quantities of associations between each tag and the item it describes, such as frequency or recency, are visually

represented with variable font sizes and colours. For example, more frequently used tags might be larger or brighter than less frequently used tags.

Web (accessible) resource: any resource which is identified by a Uniform Resource Identifier (URI). This includes all kinds of resources such as a photo, a blog, a Web site, or an article which is accessible on the Web.

Web classification: the putting of like information together in a Web context. It is used to address both the concepts of classification as process and the concept of classification as a product.

4.4 Folksonomic systems and participants selection

This study seeks to explore the ways in which people work with a folksonomy in accessing, sharing, and navigating Web resources. The data collection and analysis focus on the tagging behaviors of users who are registered in three different folksonomic systems, Connotea (www.connotea.org), Delicious (http://del.icio.us), and CiteULike (www.citeullike.org).

4.4.1 Folksonomic systems selection

In order to cover contextual conditions that might be relevant to the phenomenon of the study, i.e., users' tagging behaviors engaged in the folksonomic interactions underlying the structure of folksonomy, three folksonomic systems are selected: Connotea, Delicious, and CiteULike.

Delicious is one of the first and the leading folksonomic system with a community primarily consisting of technology and Web developers (Golder & Huberman, 2006). Delicious was founded by Joshua Schachter in 2003 and acquired by Yahoo! in 2005, and had more than five million users and 150 million bookmarked URLs (Delicious, 2009). Connotea and CiteULike are designed for scholars saving and sharing academic papers. Connotea was created by Nature publishing group in 2004, and at the time of writing it had more than 23,400 registered users and 290,000 resources with 124,000 distinct tags (Connotea, 2009). CiteULike is provided by Richard Cameron and hosted by the University of Manchester. Launched at the end of 2004, it has more than 33,000 registered users and the number of articles bookmarked in CiteULike is approaching 2 million indicated by the

roughly incremental numbering used (CiteULike, 2009).

These three folksonomic systems were chosen for several reasons: 1) because of their popularity, they have a relatively large community of active users and provide a rich set of raw data on the structure of a folksonomy shaped by users' interactions; 2) they are all designed for saving and sharing Web pages and bookmarks, and single tagging events retain their identity and can be individually retrieved; 3) they are all broad folksonomies in which many people tag many different Websites as well as the same Websites, as opposed to, for example, the photo folksonomic system Flickr, which is a narrow folksonomy, in which fewer people tag their own pictures with their own words (VanderWal, 2006); and 4) they provide several features that are relevant to our investigation of social and interactive aspects of tagging (see Table 4.1 for a comparison of these three folksonomic systems).

Table 4.1 Features of Three Popular Folksonomic Systems

		Connotea	Delicious	CiteULike
Audience		Scholarly	General	Scholarly
Features	**Popularity (users/tags)**	"Active users"	"Popular bookmarks"	"Everyone's library"
		"Popular users"		
		"Popular tags"	"Popular tags"	"Everyone's tags"
	Explore by tags	"Tag names"	"Tags" / "Explore a tag"	"Tags"
	Explore by users	"User names"	"People"/ "Go to a user"	"Users"
	Link to Relevant information	"Related tag names"	"Related tags"/ "Top 10 tags" (for this Web page by other users)	"Related tags"/ "Everyone's related tags"/ "Find related articles with these CiteULike tags"
		"Related user names"	"Everyone bookmarks for this Web page"	"Find related articles from these CiteULike users"
	Community creation	"Group"	"Network" (friends/ family/ coworker)	"Group"
Other features		"Community page" (blog)	"Tag bundles" (in my bookmarks)	"Watch list", Evaluation-mark

4.4.2 Participant recruitment and sampling

All participants for the study were recruited by posting to Connotea-Discuss mailing lists and the Web discussion boards of Delicious and CiteULike. Recruitment notices indicated that all users 19 years of age and older were eligible to participate. For a sampling method, we used a snowball technique which entails using the knowledge and contacts of existing subjects to ask for referrals to other potentially information-rich cases (Krathwohl, 1997). Snowball techniques enable us to discover members of a group not otherwise visibly

identified; in this case, those who use one or more of the three folksonomic systems but who do not subscribe to the mailing lists or participate in Web discussion boards.

Once potential participants were recruited, we sent a formal invitation to them with a link to a Web questionnaire and instructions for completing a set of diary forms (see Appendix C. Invitation Letter (example from Connotea study)). Participants of the questionnaire study were provided with an informed consent form which outlines the conditions in which they would be involved by taking part in the study (see Appendix D. Questionnaire (example from Connotea study)). Two follow-up emails were sent to non-respondents, the first one two weeks after the initial distribution and the second one three weeks after the first follow-up (see Appendix F. Reminder of study participation (example of Connotea study)).

A total of 16 people were recruited through the mailing list and Web discussion board of the three different systems (Connotea, CiteULike, and Delicious). All agreed to participate, and data collection took place between September 2008 and March 2009. Although 16 people took part in the study, data for only 12 participants were analyzed, those who finished the entire study. Of these 12 participants, four participants completed the entire study protocol, consisting of the Web questionnaire, the qualitative diary studies,

and follow-up interviews, for each of three systems (Table 4.2 shows the distribution of participants, including the four who did not complete the study. Further discussion is limited to the 12 participants who completed all parts of the study).

Table 4.2 Number of Participants

	Connotea	CiteULike	Delicious
Questionnaire	7	4	5
Diary	4	4	4
Completion	4	4	4

Table 4.3 describes demographic information of participants based on the data from the Web questionnaire. Of the 12 participants, seven were male, and five were female. One of the participants was 19-24 years old, ten were 25-34 years old, and one was 45-54 years old. As described in Table 4.3, most participants reported that they had used the system for more than three months, except one participant who at the time of the study had started using the system very recently. They were using the system very regularly, from 2-3 times per week to more than twice a day. For confidentiality purposes, participants are referred to by numbers rather than by their names.

Table 4.3 Demographic Information of Participants

Participant	System studied	Gender	Age	Frequency of using the system	Experience of the system
1	Connotea	Male	25-34 years	Two to three times per week	2-3 years
2	Connotea	Male	25-34 years	Less than once a week	2-3 years
3	Connotea	Male	25-34 years	Four to six times per week	7-12 months
4	Connotea	Female	45-54 years	Once a day	Recently (less than 3 months)
5	Delicious	Female	25-34 years	More than twice a day	2-3 years
6	Delicious	Female	19-24 years	More than twice a day	1-2 years
7	Delicious	Male	25-34 years	More than twice a day	7-12 months
8	Delicious	Male	25-34 years	Two to three times per week	More than 3 years
9	CiteULike	Male	25-34 years	Four to six times per week	3-6 months
10	CiteULike	Female	25-34 years	More than twice a day	3-6 months
11	CiteULike	Male	25-34 years	Two to three times per week	2-3 years
12	CiteULike	Female	25-34 years	Four to six times per week	3-6 months
SUMMARY	4 Connotea 4 CiteULike 4 Delicious	7 Male 5 Female	1 19-24 yrs 10 25-34 yrs 1 45-54yrs	3 2-3 times per week 3 4-6 times per week 1 Once a day 4 More than twice a day	1 Recently 3 3-6 months 2 7-12 months 1 1-2 years 3 2-3 years 1 More than 3yrs

4.5 Pilot study

Before the data collection for the study began, a pilot study was conducted to test all

of the data collection instruments and methods for their viability, based on the case of Connotea. A pilot study is an opportunity for the data collection instruments to be refined and for the data collection processes to be rethought. Three major data collection methods, including a Web questionnaire, the qualitative diary studies and follow-up interviews were tested.

One goal of the pilot study is to detect any flaws in the questions and structure of a Web questionnaire and correct these prior to the final study. The questionnaire was refined and finalized using a two-stage process. The questionnaire was first tested on four graduate students and colleagues at the University of British Columbia (UBC) during the period from April 1 to April 7, 2008. It was found that participants did not understand the different usage of tags, i.e., tags for 'organizing the items in your personal collection' and those for 'sharing the items with others in Connotea', and felt that these questions were repetitive. Minor modifications were made on this basis, highlighting these different purposes of tagging (i.e., 'managing the items in your personal collection for your personal use' versus 'sharing the items in your collection with others'). After completing the first pilot survey of the questionnaire, the researcher made amendments in order to clarify some ambiguous questions and minimize the error rate on answers.

The modified questionnaire was tested in a second pilot study during the period from June 16 to July 12, 2008. Another three graduate students, recruited from the School of Library, Archival, and Information Studies (SLAIS) at UBC through the school's student listserv, participated in pilot testing of the questionnaire and the diary form designed for the Connotea study. After completion of the second pilot study, comments were also obtained on the wording and overall design of the questionnaire. Concerning the design and structure of the questionnaire, the participants found it relatively easy to complete and understand. However, some participants tended to provide very brief answers to the questions associated with the purpose of the folksonomic system, Connotea, and the process of tagging that they usually follow; thus it was determined that it might be necessary to carry out additional follow-up interviews with participants through e-mail after the study to obtain useful data.

The second goal of the pilot study was to develop a folksonomy diary form which allows participants to more easily and more accurately record their usage of folksonomic systems relating to their tagging behavior. A diary form was tested on three graduate students in the second pilot study with Connotea, which evaluated feasibility of the diary study as well as the participants' understanding of the modified questionnaire. The second

pilot study required participants to record their tagging behaviors at the end of each day using a set of diary forms designed for the Connotea study (see Appendix E. Diary Form (example from Connotea study)). Participants used the Connotea diaries over a one week period, and recorded all interactions with Connotea including the bookmarked items, the reason for tagging, tags they assigned in bookmarking the items, and features of Connotea they used.

The role of the diary study is to generate rich data on participants' interactions, such as their reflection on tagging activities and motivation for tagging, that may otherwise be difficult to observe. The pilot study examined whether the diary method can act as a surrogate for direct observation of the participants, and if the format and one-week period of the diary study are acceptable to participants. Upon completion of the second pilot study, participants were asked about the ease of use of the diary form, and whether the Connotea Diary Form was able to accommodate most of the tasks in which they engaged when interacting with Connotea. The participants recorded an average of 12 tagging events over a one week period (each event involved with tagging activities such as editing, deleting, adding, or copying bookmarks from others must be recorded on a separate diary form). The interviews with participants after the pilot study revealed that the format and period of the

diary study were generally acceptable. Based on this experience, it seemed that the diary study would be a useful method to generate a rich source of data about participants' motivation and interaction in tagging items. The diary study also served as a guide for the follow-up interview. Based on what the participants wrote, they were asked to elaborate on their experiences, motivation, and the contexts associated with tagging activities in the follow-up interview session.

Additionally, the pilot study offered an opportunity to begin developing the foundation for a coding scheme to be described in Chapter 5, Data Analysis and Coding which includes the process used to develop a codebook and analyze data.

4.6 Data collection

Data were collected during the period from September 2008 to March 2009. Four types of participant data were collected: the Web questionnaire, the qualitative diary studies, and follow-up interviews with the participants, and the data from three folksonomic systems recording the participants' complete history during the study such as the use of tags and tag lists in their personal collection. The questionnaire data consist of participants' subjective perceptions and self-report about their tagging experience involved with their

folksonomic interactions. The questions in the questionnaire are derived from the research questions (Research Questions 1, 2, and 3), most of which are presented in an open manner so that the participants' views about their perception and experience with tagging in using folksonomic systems are brought out in their own words. The questionnaire includes 30 questions that cover the demographics of the participants (Part I. Background Questions: questionnaire questions 1-9); their tagging patterns (question 12); the types of tags that they use (Part II. Types of Tags: questionnaire questions 13-18); the features of folksonomic system they use during tagging (Part III. System Features: questionnaire question 19-27); and their overall experience with folksonomic systems (Part I. Background Questions: questionnaire questions 10, 11, and Part IV. Comments: questions 28-30).

The in-depth description and analysis of participants' tagging behavior is based on data collected through diary studies and interviews with participants. All participants are asked to keep a folksonomy diary, recording tagging events that occur during their daily lives, for a period of a week. The Folksonomy diary is designed to capture information about participants' everyday use of folksonomic systems, including how they classify items in a specific category and how they name these categories with certain tags; the reasons why they choose to use these tags; and what features of folksonomic systems they use in

the tagging process. Each participant was asked to complete diary forms over a one week period. If they had not completed at least 10 entries by the end of a week, participants continued for a second week. This diary data offers the exploratory and factual information which reveals the participants' usage of tags in using a folksonomic system in a natural setting without the distracting influence of the researcher.

Additional interviews with the participants were conducted via e-mail to complement the diary data. The follow-up interviews provide more detailed information about their use and perceptions of tags and tagging behavior in using folksonomic systems. E-mail interviews can be friendlier to participants than face-to-face interviews, allowing the participants to take their time in answering questions without the interruption of the interviewer and the problem of interviewer effects, for example arising from personal communication skills (Meho & Tibbo, 2003; Zhang, 2001). Based on responses provided by the participants, questions were asked related to their associated tagging experiences and processes. For example, when a follow-up interview was conducted with one participant who used the term of 'wrong tag' in his description of diary study, the questions included:

> What did you mean when you said 'this tag is wrong'? And why did you think it 'wrong'? As you said, you thought you should not have used it, but you added those kinds of 'wrong tags'. Why did you decide to keep the wrong tag as well

as other tags? (Follow-up interview questions for Participant 2).

All tags which participants assigned during the period of study were collected in order to complement the qualitative data of diary studies and interview studies. By looking over the public information on use of tags, it is clear which tags are most frequently used and how they are related to one another. These data include individual libraries and group pages of participants which comprise folksonomies. The changes of popular-links pages, such as the lists of popular users and tags were also recorded and collected for later analysis.

4.7 Enhancing trustworthiness and credibility of the findings

This study employed four methods to help ensure rigor in the conduct of the study: triangulation, member checks (participants' review process), peer review, and reflexivity. Triangulation is a method for using multiple theories, multiple researchers, or multiple approaches to confirm emerging findings. Member checks ask some of the study participants to review the interpretation and findings for plausibility. Peer review is a method of discussing the study with colleagues. Reflexivity means the researcher's reflections on his or her role, assumptions, worldview, and biases, rather than ignoring them or believing that they can be controlled (Creswell, 1998; Patton, 1990).

This study employed all of these methods to help ensure trustworthiness and credibility of the findings. Triangulation was introduced in data collection through the use of multiple methods (Web questionnaires, diary studies, and follow-up interviews). Also, the study entailed frequent peer review, exercised reflexivity, and conducted a pilot study to enhance data collection. For member checks, participants were asked to review whether the researcher interpreted their thoughts correctly and used their quotes appropriately. The findings were shared with four of the participants and their feedback sought to enhance the credibility of the research. In addition, the progress of the research was tracked through a detailed account of methods, progression, and decisions, by keeping a research journal.

5 DATA ANALYSIS AND CODING

5.1 Data analysis procedures

5.1.1 Inductive coding and constant comparison method of grounded theory

In terms of data coding, systematic techniques of qualitative research drawn from grounded theory were adopted. Data analysis uses inductive coding and the constant comparison method of grounded theory guided by Strauss and Corbin (1990) and Lincoln and Guba (1985). The qualitative data of questionnaires and diary studies are coded in terms of Strauss and Corbin's inductive coding (1990):

> [codes are] inductively derived from the study of the phenomenon. That is, discovered, developed, and provisionally verified through systematic data collection and analysis of data pertaining to that phenomena (p.30).

Such generated codes facilitate making comparisons. This study follows the constant comparison method which entails a systematic and standard format:

- Open coding: the researcher forms initial categories of information about the phenomenon being studied by segmenting information. Within each category, the investigator finds several properties, or subcategories, and looks for data to dimensionalize, or show the extreme possibilities on a continuum of the property.

- Axial coding: the researcher assembles the data in new ways after open coding. This is the process of relating categories to each other. During axial coding, the researcher seeks to make explicit connections between categories and subcategories, and identify casual relationships between categories.
- Selective coding: the researcher selects and identifies the core category that integrates the categories in the axial coding model (Creswell, 1998).

To begin, the text areas of the Web questionnaires and diary studies were coded openly, according to apparent themes, while short memos were written. Every line of each diary study was coded, sometimes with multiple codes according to the description of why the participant used a specific tag in bookmarking a specific item. For example, the tag named 'Health Canada' to represent the source as well as content of the item is assigned two codes, Topic and Source. A qualitative data analysis software program, NVivo 8 was used as a tool to manage the process of coding and linking concepts and to enable effective searching and retrieval of quotations. All tags that participants generated during the study periods were first entered into Nvivo 8 and were coded; and an Excel spreadsheet was later used for creating raw data counts such as types of tag participants used. The second stage of the analysis was creating flowcharts of the participants' tagging processes based on data

collected through the Web questionnaire, qualitative diary studies, and follow-up interviews. These flowcharts were also prepared with analysis and synthesis of important tree nodes and relationships in NVivo 8.

5.1.2 Initial concepts derived from pilot study and conceptual framework

The initial concept and categories were derived from the results of the pilot study and conceptual framework of this study. These initial concepts and categories became the starting point for the coding scheme that was further developed throughout the data analysis process of the final study. The initial search for patterns and themes was to begin the process of their development and to understand the issues mentioned by the participants in the pilot study. Table 5.1 describes the categories and subcategories identified in the pilot study, including the process of tagging, types of tags, tagging activities and features of folksonomic systems, which are posited in this study's research questions and conceptual framework. These pilot study categories further guided an investigation of empirical indicators and the development of concepts grounded in the data.

Table 5.1 Initial Concepts Emerging from Pilot Study

Research Question	Categories	Subcategories
1. Tagging activities involved	Item selection	Search for a certain tag/resource Access Web resources Add bookmark
	Tag assignment	Create new tags Replace tags Delete tags Add tags
	Tag searching/discovery	See others' tags/ popular tags Navigate related tags Discover new tags
2. Tagging motivations	Personal information management	Tagging for personal purposes
	Social sharing	Tagging related to group-work
	Combined	Tagging for personal information management as well as social sharing purposes
3. Types of tags used (based on Golder & Huberman (2006))	Topic/subject	Levels of specificity
	Format/ Kind/ Type	Format
	Ownership/ Source	Ownership
	Refining	Geography specific Time specific Feature specific
	Qualities/Characteristics	Opinion Quality
	Self-reference	Self-reference People (group) specific
	Task-related	Group work related Personal work related
4. Features of folksonomic systems	Popularity	Link by popular users Link by popular tags
	Explore by tags	Explore by tags
	Explore by users	Explore by users
	Link to relevant information	Link by related tags Link by related users
	Community creation	Work-related group Non work-related group
	Other features	Community page(blog) Tag bundles

5.2 Coding

5.2.1 First-round coding

The first round of coding consisted of open coding, that is, the process of selecting and naming categories from the analysis of the data (Glaser & Strauss, 1990). Each line, sentence, and paragraph of the Web questionnaires, diary studies, and follow-up interviews was analyzed to explore general categories, sub-categories, and properties. The initial concepts and categories of tagging behaviors and interactions, which were derived from the conceptual model and the results of the pilot study (see Section 5.1.2 Initial Concepts Derived from Pilot Study and Conceptual Framework, and Table 5.1), guided a preliminary structure of categories, sub-categories and properties during open coding. After the first round of analysis, the coding scheme underwent an extensive examination during which all text assigned to each of categories was reviewed. This process allowed for greater understanding of the nature of each category, for refining the definitions of the categories, and for developing an initial understanding of the relationships among the categories.

5.2.2 Subsequent coding, cross-case analysis, and codebook development

The initial concepts and categories were refined and expanded on three research

questions of this study relating to tagging behaviors and interactions: (1) tagging activities involved in the tagging process; (2-a) tagging motivations; (2-b) types of tags used; and (3) features of the folksonomic system. Some synonymous categories were merged, and others were separated into discrete concepts.

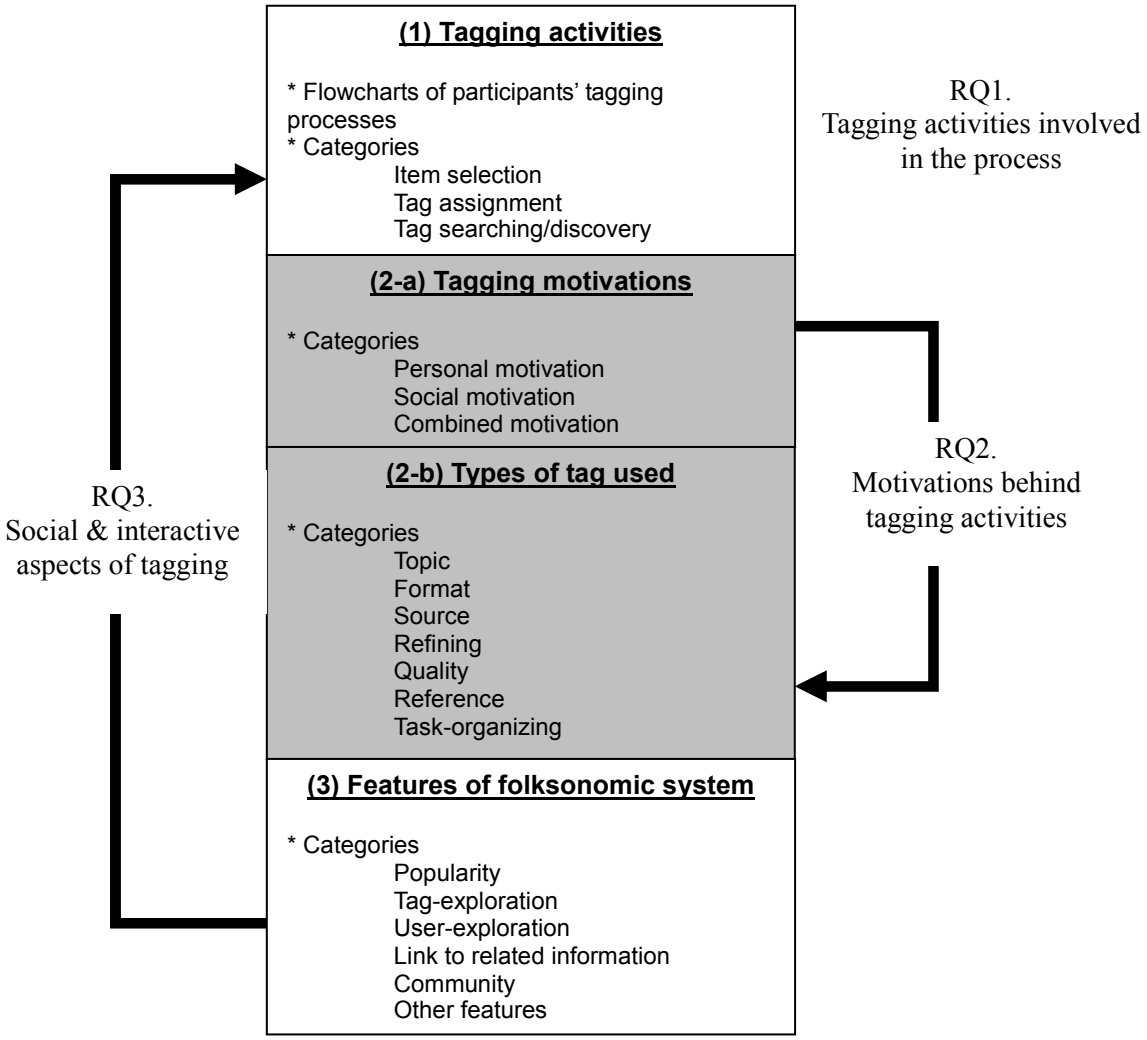
Coding continued until recurring themes and the patterns of their relationships became evident with the data. As data analysis was ongoing, the coding scheme continued to evolve. Subsequent coding was focused on refining themes and patterns associated with the research questions of this study, which will be discussed in later chapters. Subsequent refinements of the scheme resulted in the final codebook in Appendix G.

5.3 Research questions and major concepts of tagging behaviors and interactions for data analysis

This study aims to explore the usage and understanding of folksonomy as a Web classification, asking how folksonomic system users are tagging in order to utilize a folksonomy. This overall question leads to three research questions and their initial conceptual categories, focusing on an investigation of tagging behaviors and interactions involved with the structure of folksonomy. Figure 5.1 illustrates the conceptual categories and their relationship with research questions of this study. The major categories are drawn from three research questions: (1) tagging activities involved in the tagging processes; (2-a)

tagging motivations; and (2-b) types of tags used; and (3) features of folksonomic system used. Figure 5.1 illustrates the basic definition of the major concepts and categories for data analysis.

Figure 5.1 Research Questions and Major Concepts for Data Analysis



RQ1. Tagging activities involved in the tagging process
(Questions of interest include)

- How do participants tag Web resources?
- What activities are involved in tagging processes?
- What features of folksonomic system do participants use during tagging?

RQ2. Tagging motivation behind tagging activities
(Questions of interest include)

- How do they relate their tagging motivations to the tag decision?
- What are participants' motivations for tagging?
- What function do they perceive their tags performing?

RQ3. Social and interactive aspects of tagging
(Questions of interest include)

- How do participants perceive the social & interactive aspects of tagging?
- To what extent, do they consider others' tags & tagging behaviors during tagging?

5.3.1 Tagging activities involved in the tagging process

The tagging processes of 12 participants are presented in flowcharts (see Figures 6.5-6.18.2). The flowcharts graphically illustrate models based on processes by which the participants classify Web resources, representing the activities involved when they assign tags to Web resources, in response to the first research question. Flowcharts help with generalization of the tagging process of participants. They more clearly present the participants' tagging process by excluding details of their reasons for particular processes and decisions as well as problems associated with them. There are different models illustrated in the flowcharts by different participants.

The tagging activities involved in the tagging process are analyzed and described in three main categories: item selection, tag assignment, and tag searching and discovery (detailed in Table 5.2). These categories are basically derived from the conceptual model of this study (see Figure 3.4, Tagging Activities) and include the reason for each activity through diary studies and interviews with participants. Major concepts and categories relevant to tagging activities and interactions guide a detailed account of activities including the reasons why participants chose the specific tagging activity, and problems associated with them during tagging processes

In particular, the concepts and categories relating to tag searching and discovery link to the third research question, examining the social and interactive aspects of tagging (see Figure 5.1). Further analysis of data from diary studies leads to an investigation of the participants' perceptions of social and interactive aspects of tagging, and how this affects their tags and tagging behaviors.

Table 5.2 Major Concepts & Categories of Tagging Activities Involved in Tagging Process for Data Analysis

Concepts	Categories	Subcategories
Item selection	Access Web resource	• Access resource from people outside the social network in the folksonomic system • Access resource through the folksonomic system (i.e., using the features of system or the social network in the system) • Import resource from the existing reference
	Add a new resource	• Add a new bookmark • Copy from others' bookmarks
	Decide privacy setting	• Keep the bookmark private • Keep the bookmark public
Tag assignment	Examine the bookmark for tagging	• Identify significant characteristic of the bookmark • Consider tag plan
	Add tags	• Generate new tags • Copy tags from the existing ones
	Review the assigned tags	• Review the completion of tagging • Review the verification of the tag
	Edit tags	• Rename tag • Delete tag • Leave tag intact
Tag searching/ discovery	Browse tags	• Browse the most popular/recent tags (using the popularity features of the folksonomic systems) • Browse the related tags (using the link-to-related information features of the folksonomic systems)
	Search for a specific tag	• Direct search for a specific tag (using the search features of the folksonomic system)
Others	Other tagging activities	• Edit a setting (e.g., subscription of RSS feeds[5]) • Activities related to group/ network

5.3.2 Tagging motivations

The major concepts underlying tagging motivations fall into three categories: (1) personal tagging motivation; (2) social tagging motivation; and (3) combined tagging motivation (detailed in Table 5.3). These concepts and categories are linked to the second

[5] An RSS feed means a computer readable file which summarizes the information published on the system over a recent time period.

research question about the motivations behind tagging activities with analysis of the types of tags participants used, which will be discussed in Section 5.3.3 Types of tags (see Figure 5.1). Further analysis leads to a better understanding of the way in which participants relate their motivation to the tag decisions made in the tagging process.

Table 5.3 Major Concepts & Categories of Tagging Motivation for Data Analysis

Concepts	Categories	Definition and incidents
Tagging Motivation	Personal Motivation	• Tagging for personal information management purposes • Only personal purposes of collecting and storing references, without any intention of sharing with others
	Social Motivation	• Tagging for sharing information with others • Job or group working related tagging, with an intention of sharing with others
	Combined Motivation	• Tagging for personal information management as well as social sharing purposes. • Identified a discrimination between personal and social tagging

5.3.3 Types of tags

The types of tags were analyzed and described in seven categories which are adapted from those of Golder and Huberman (2006) (detailed in Table 5.4). After the pilot study, it was found that some amendments of Golder and Huberman's seven categories were needed in order to fully describe the data. Among their seven categories, the 'Self reference' category was modified to the 'Reference' category so that types of tags were included

which identify content in terms of its relation not only to the tagger, but also to the specific user names or target audience with whom the tagger wants to share. For example, based on the description in the diary study, a tag ‘for school teacher’, or which a participant added as a special tag or one in the format of ‘for: username’ to send links to other users, is coded as a ‘Reference’ tag.

In addition, the categories, ‘Refining’ and ‘Task-related’ were reorganized so that the codes were more clearly defined. ‘Refining’ categories were reorganized, including geography and time specific tags, and ones indicating specific features that are generally followed by ‘-features’, or ‘-contains’. ‘Task related’ categories also included tags specifying a group name, and the function of the bookmarked item. The major concepts and categories regarding the types of tags are defined for this study as shown in Table 5.4.

Table 5.4 Major Concepts & Categories of Types of Tags (Adapted from Golder & Huberman (2006))

	Categories	Definition	Examples
A	**Topic , Subject**	• Identifying what it is about • Includes common nouns of many levels of specificity, as well as many proper nouns, in case of content discussing people or organization • General (broad)subject/specific subject	Health Web2.0 RDF virtual library
B	**Format, Kind, Type**	• Identifying what it is • Identifying what kind of thing a bookmarked item is	blog, journal, article tutorial, review, survey, lyrics opensource, Mp3
C	**Ownership, Source**	• Identifying who owns it • Identifying the source of item	Health Canada Taylor, Youtube
D	**Refining**	• Refining or qualifying existing tags • Including common adjectives which specify the item (e.g., recent, social) • Geography specific (e.g., California) • Time specific (e.g., 2008) • Indicating specific features : - features, - contains, - inspired by, - spurred about	free, official Florida, Atlanta Korean, date (July 10/July 7) blackfriday music(features)
E	**Affective, Qualities, Characteristics**	• Identifying qualities or characteristics • Generally expresses the tagger's opinion of the content	Important funny interesting

	Categories	Definition	Examples
F	**Reference**	• Identifying content in terms of its relation to the tagger • Beginning with 'my' • Identifying a specific user name, target audience to share with : - for** (teacher, scholar, mobile user) • Includes group tags: identifying a specific group name	my paper Red college Mobile user For: **
G	**Task-related**	• Related to performing a task • Related to research work/teaching • Related to group work • Related to the function of the bookmarked item (e.g., annotate/ test/sharing)	Toprint, To read class# download, publication reference questions

5.3.4 Features of folksonomic systems

The features of the folksonomic system that participants used are described and analyzed in five categories (detailed in Table 5.5): (1) Popularity; (2) Searching by tag or user name; (3) Link to related information; (4) Community participation; and (5) Other features. These major concepts and categories relevant to the features of folksonomic systems are linked to the third research question about the social and interactive aspects of tagging, how participants consider others' tags and tagging behaviors during tagging. In addition, taking the major concepts and categories regarding tagging activities together,

further analysis leads to a better understanding of how this affects their tags and tagging behaviors.

Table 5.5 Major Concepts & Categories of Features of Folksonomic Systems for Data Analysis

Concepts	Categories
Popularity (user/tag)	• Popular user • Popular tag
Searching by user/tag	• Searching by user name • Searching by tag
Link to related information	• Link to related tags • Link to related users
Community participation	• Collaboration • RSS feed
Other features	• “Community page” of Connotea • “Tag bundle” of Delicious • Evaluation-mark of CiteULike

6 FINDINGS AND OVERVIEW OF THE RESULTS

6.1 Descriptive statistics

6.1.1 Summary of tag usages

After completing the Web questionnaire, participants were provided with the diary forms designed for each of three systems. They were asked to record all their activities involved with tagging (e.g., adding a bookmark, renaming a tag, deleting a tag), using a structured diary form. Each form in the diary captured information about a single item they bookmarked and details of the tagging activities involved with this bookmark: why they tagged this item, the tags which they assigned for that item, why they used these tags, and the features of system they used (see Appendix E. Diary form (example from a Connotea study)).

Each participant was asked to complete diary forms over a one week period. If they had not completed at least 10 entries by the end of a week, participants continued for a second week. Of the 12 participants, five participants continued for a second week. Table 6.1 includes a summary of tag usage based on the qualitative diary studies of the twelve participants. The number of entries which each participant provided ranged from a

maximum of 40 to a minimum of 10 during the study period; the average number of entries per participant was 18 entries.

The qualitative diary studies of twelve participants produced about 957 tags (or an average of 80 tags per participant) in total. The number of tags which each participant assigned ranged from 32 to 174. Participants assigned a mean of 4.32 words per entry, or a single item which they bookmarked.

Table 6.1 Summary of Tag Usage Based on the Diary Studies

Participant	System studied	Days using	Total entries	Total tags assigned	Distinct tags assigned	Average No, of tags assigned	System recommended tags
1	Connotea	8	11	38	36 (95%)	3.8	32 (84%)
2	Connotea	27	19	80	38 (47%)	4.2	32 (40%)
3	Connotea	7	38	174	72 (41%)	4.6	76 (44%)
4	Connotea	5	15	64	31 (52%)	4.3	0 (0%)
5	Delicious	6	18	78	61 (78%)	4.3	0 (0%)
6	Delicious	11	40	173	114 (66%)	4.3	1 (1%)
7	Delicious	8	11	38	28 (36%)	3.5	0 (0%)
8	Delicious	7	11	50	42 (84%)	4.5	47(94%)
9	CiteULike	6	11	32	18 (44%)	2.9	1 (3%)
10	CiteULike	7	24	119	63 (53%)	5	0 (0%)
11	CiteULike	10	11	77	28 (64%)	7	0 (0%)
12	CiteULike	7	10	34	24 (71%)	3.4	3 (9%)
SUMMARY OR MEAN	4 Connotea 4 CiteULike 4 Delicious	Averg. 9.8 days/ particip -ant	Averg. 18.25 entries/ participa -nt	Total 957 (100%)	Total 555 (58%)	Averg. 4.32 tags/ item	Total 192 (20%)

Of the 957 tags, 555 tags (that is, 58%) were distinct words, which were used only once in the period of study, based on the analysis of qualitative diary studies. Of the 957 tags, 195 tags (that is, 20%) were chosen from the words which the system recommended.

Table 6.2 gives an overall summary of the types of tags which the 12 participants used during the study period. The researcher carried out qualitative data analysis on every tag from the diary studies based on the seven categories previously identified (Section 5.1.2 Initial Concepts Derived from Pilot Study and Conceptual Framework, see Table 5.4). On the basis of their description, some tags were coded by more than one type of code.

Table 6.2 Summary of Types of Tags Based on the Diary Studies

Participant	A (Topic)	B (Format)	C (Source)	D (Refining)	E (Qualities)	F (Reference)	G (Task)	Total Tags
1	33 (73%)	4 (9%)	6 (14%)	1 (2%)	1 (2%)	0 (0%)	0 (0%)	45
2	62 (74%)	5 (6%)	0 (0%)	0 (0%)	2 (2%)	2 (2%)	14 (16%)	85
3	96 (52%)	28 (15%)	2 (1%)	10 (6%)	1 (1%)	4 (2%)	43 (23%)	184
4	26 (37%)	4 (6%)	10 (14%)	15 (21%)	0 (0%)	2 (3%)	13 (19%)	70
5	56 (69%)	12 (15%)	10 (12%)	0 (0%)	2 (3%)	1 (1%)	0 (0%)	81
6	115 (58%)	12 (6%)	23 (12%)	30 (15%)	16 (8%)	1 (0%)	2 (1%)	199
7	27 (71%)	6 (16%)	0 (0%)	3 (8%)	1 (2%)	0 (0%)	1 (3%)	38
8	37 (70%)	11 (20%)	1 (2%)	2 (4%)	0 (0%)	1 (2%)	1 (2%)	53
9	23 (66%)	2 (6%)	0 (0%)	3 (8%)	0 (0%)	1 (3%)	6 (1%)	35
10	84 (64%)	9 (7%)	0 (0%)	2 (1%)	1 (1%)	10 (7%)	26 (20%)	132
11	54 (76%)	2 (3%)	0 (0%)	4 (5%)	0 (0%)	2 (3%)	9 (13%)	71
12	19 (50%)	6 (16%)	0 (0%)	3 (8%)	0 (0%)	2 (5%)	8 (21%)	34
SUMMARY OR AVERAGE	632 (61%)	101 (10%)	52 (5%)	73 (7%)	24 (2%)	26 (3%)	123 (12%)	957

Qualitative diary studies revealed that a majority of the tags participants used (61%) were topic tags; 12% were task-organizing tags; 10% were format tags; and 7% were refining tags (Table 6.2, and Figure 6.1). This result is almost the same as the distribution of participants' responses to the question about the most frequently used tags (Figure 6.2), even though some categories were modified after the questionnaire studies.

Figure 6.1 Total Types of Tags Used by 12 Participants Based on Their Diary Studies

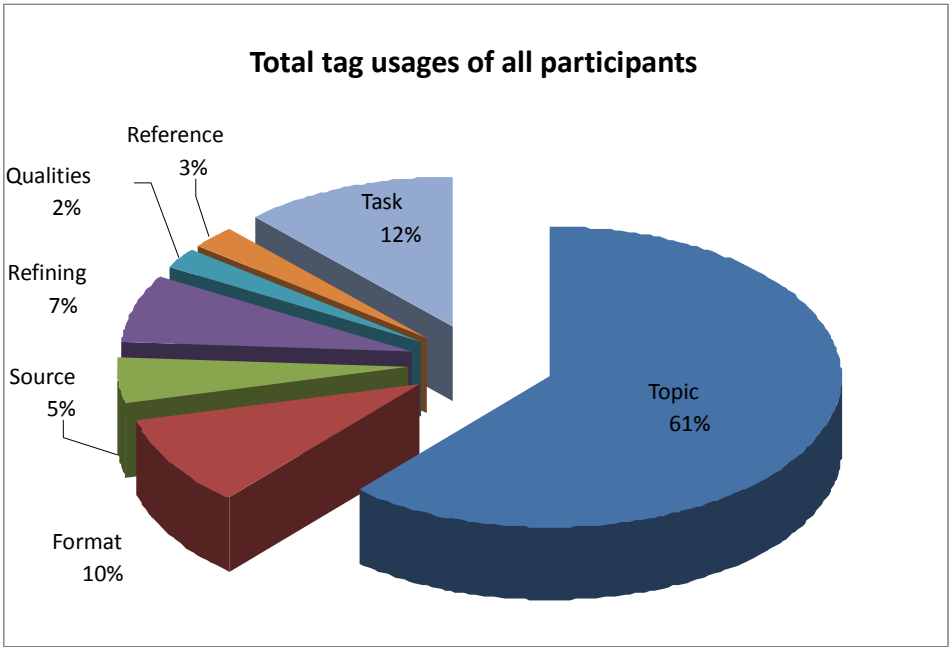
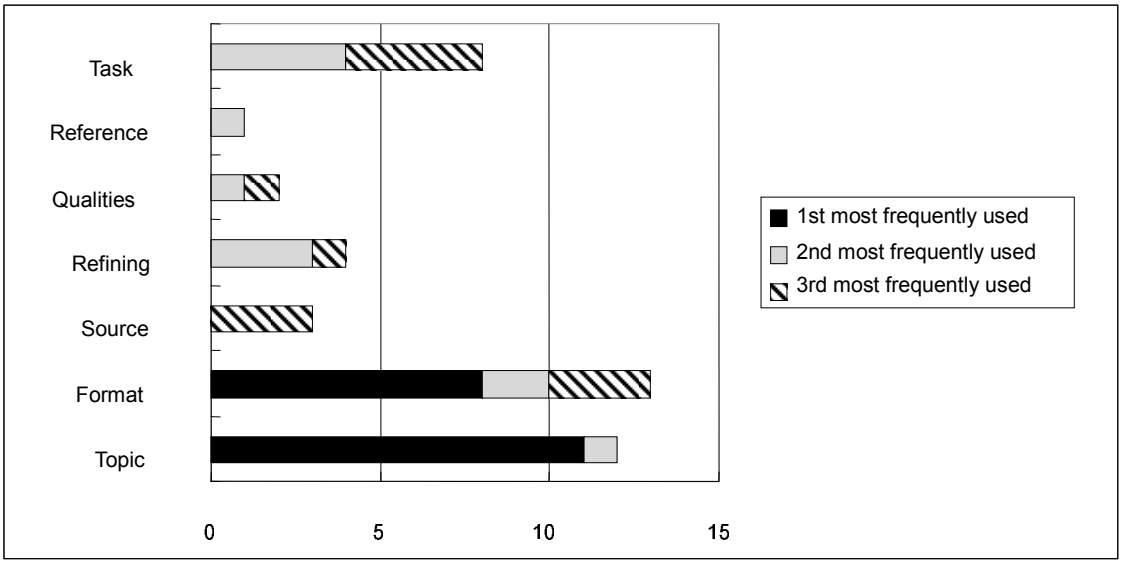


Figure 6.2 The Most Frequently Used Types of Tags Based on Questionnaire Data



6.1.2 Types of tags useful for different purposes

In searching for types of tags which participants perceive to be useful, the researcher

asked two different questions in the Web questionnaire: (1) which do you think is the most useful in order to "manage" the items in your personal collection for your personal use? and (2) which do you think is the most useful in order to "share" the items in your personal collections in the system? For these two questions, participants were asked to rank their top three most useful types of tags.

Figures 6.3 and 6.4 show the types of tags which participants perceived to be useful for personal information management and social sharing purposes. Regardless of the different purposes of tagging, most participants reported that they thought the topic tag was most useful. In terms of personal information management purposes, of the 12 participants, nine selected the topic tag as the most useful and two selected it as the second most useful (that is, 92% in total) (Figure 6.3). In terms of social sharing purposes, ten answered that the topic tag was the most useful, and one answered that topic was the third most useful (that is, 92% in total) (Figure 6.4).

Figure 6.3 The Most Useful Types of Tags for Your Personal Information Management (PIM) Based on Questionnaire Data

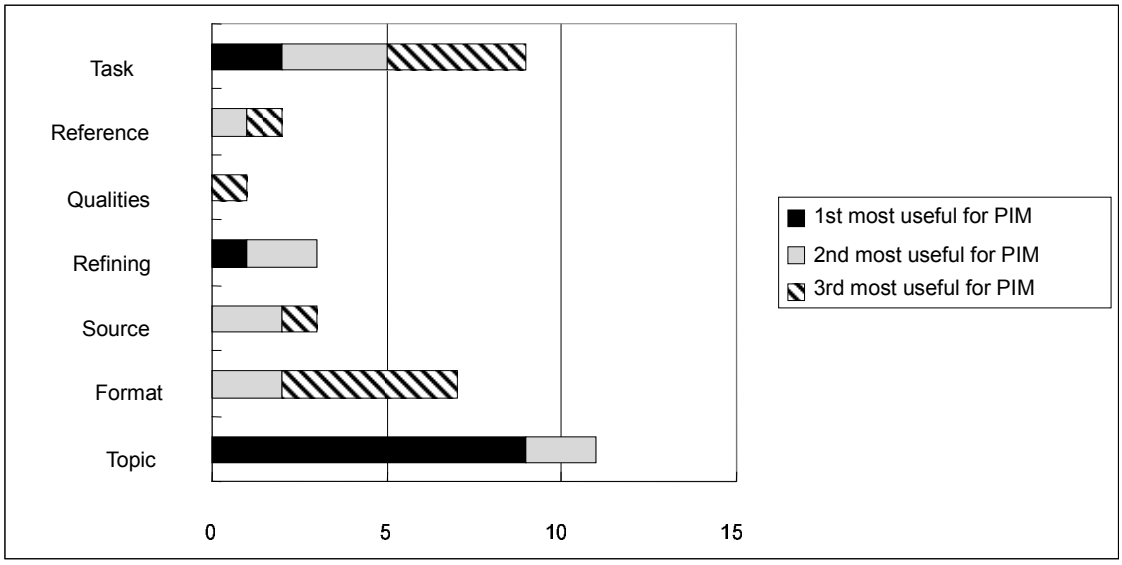
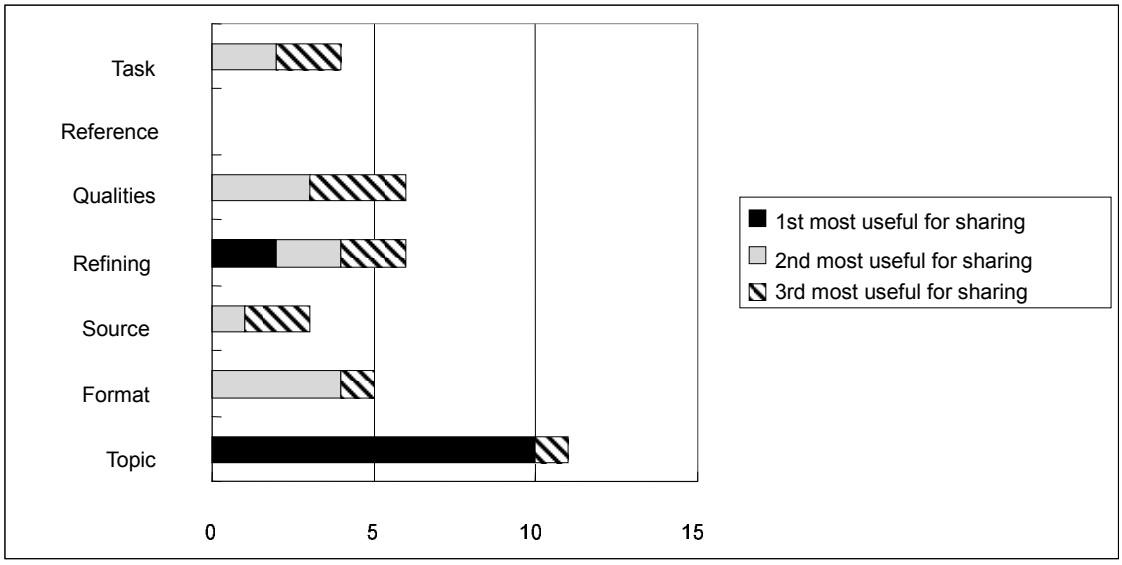


Figure 6.4 The Most Useful Types of Tags for Sharing with Others Based on Questionnaire Data



As seen in Figures 6.3 and 6.4, there is a slight difference between the most useful types of tags for different purposes. In terms of personal information management purposes,

participants listed task-organizing tags and format tags in order of usefulness. However, in terms of social sharing purposes, they listed refining tags and tags identifying qualities or characteristics as more useful than task-organizing tags.

6.2 Individual participant narratives

There are 12 participants who completed the entire study protocol (see Tables 4.2 and 4.3 for details of these participants). This section describes the individual participants' tagging experiences, their use of tags and folksonomic systems, and overall understanding of a folksonomy. The descriptions are based on participants' data collected through the Web questionnaire, qualitative diary studies, and follow-up interviews. These descriptions attempt to show how individual participants were tagging, using the folksonomic systems during the study. Description of their analysis sessions are included in these narratives, as are descriptions of the participants' personal comments, interests, and specific details related to their tagging experiences using each of three folksonomic systems, Connotea, Delicious, and CiteULike. Narratives of participants who use the same folksonomic systems are presented together. Each description is presented in relation to the four research questions of the study: overall process/pattern of tagging, tagging activities and interactions,

types of tags, and features of folksonomic systems used. Extensive illustrative quotes from transcripts are included to let the participants' own words describe their experience and understanding of tags and a folksonomy. Comments from the participants' diaries are referenced by entry number. In a few cases, where use of a specific tag or resource might compromise a participant's anonymity, the tag is replaced with XXX or an equivalent tag or resource is substituted.

Participant 1

Participant 1 was very sophisticated in using the folksonomic system and tags; he used extensions to Connotea to add tags, and knew how to advertise his paper using Connotea. He was actively engaged in the discussion of Connotea improvement, posting his suggestions to the Connotea mailing lists.

Participant 1 has used Connotea for three years. He was using several other folksonomic systems, including Flickr, blogspot, and the particular folksonomic system which he invented for his own research project. He stopped using Delicious as he found its functionality was too similar to justify using both Delicious and Connotea. He regarded Connotea as the primary repository of his bookmarks for later retrieval but felt the

difficulty of refinding the tagged item, saying:

> [I] store my bookmarks for later retrieval (though this doesn't actually work that well in reality - I am more likely to go to google to look for something I've tagged in Connotea than I am to actually go back to Connotea.

Participant 1's tagging approach varied with each item and purpose of tagging. Even though he answered that he had no specific process that he usually followed, he commonly tagged the item by topics, using many specific tags. He assigned an average of 3.8 words per item. For some items, he assigned both general as well as specific topic tags. It seems that he attempted to build a hierarchical structure with his own tag collections. For example, when he tagged the Web page related to open shelves classification, he assigned three topic tags together; 'Social Semantic Web' which he indicated was a 'general subject', and 'social cataloging application' and 'Dewey Decimal Classification' which indicated a more specific subject (*diary entry #6*).

Participant 1 perceived a difference between personal and social purposes of tagging. In terms of personal information management purposes, he thought task-organizing tags were the most useful, topic tags were the second most useful, and source tags were the third most useful. He commented on the task-organizing tags:

> task organizing tags like to_read function as a to do list for me. I subscribe to my own rss feed associated with that tag and try to remove it from things i've

> read. the other types are the ones i use most frequently for re-finding attempts (when google fails me).

However, the diary study found that he didn't use any task-organizing tags during the eight-day study period.

In terms of social sharing purposes, he listed topic tags as the most useful, tags identifying qualities or characteristics as the second most useful, and source tags as the third most useful. He said:

> the topics and creators should be least specific to me and therefore probably the most relevant to the broad community of connotea users - who I do feel like I am sharing with when I bookmark. The qualities (e.g., 'important') are probably more important to the smaller community that follows me specifically to increase the likelihood that they will attend to something that [I] bookmark.

Participant 1's motivation targets himself as well as others. He kept his entire set of references public for anyone to see. He was very aware of the social and public values of a folksonomic system. He perceived tags as a way to communicate with other users of folksonomic system. He used the word 'community' to describe the users of Connotea. He saw Connotea as a community where other Connotea users could communicate with each other through tagging. When he added a specific bookmark, he reported the reason why he was tagging that item: "I thought it was interesting and wanted to signal that to others" *(diary entry #5)*.

In addition, during the study, he was found to add a specific tag intentionally in order to promote his paper to other Connotea users. He mentioned it in his diary: "It cites one of my papers; (I) want to advertise it to my friends" *(diary entry #11).*

When Participant 1 assigned the specific tag, 'crawler[6]' to the item which cited one of his papers, he described the reason why he used this specific word as a tag:

> This tag is a distinct word from the title of my paper, which this article cites. I use it to track things related to that paper *(diary entry #11).*

Participant 1 had a strong sense of the navigation function of tags which led him to find like-minded others across geographic or organizational boundaries. He preferred serendipitous discovery of related information through the features of Related Users, Tag Names, and User Names. About the Related Users feature, he reported:

> the related users feature has been interesting for discovery[;] the RSS feeds are important and useful[; and] the structure of the system makes navigation through it very intuitive.

Participant 1 was engaged in two groups: one associated with the facility and the other associated with curriculum. He thought the group functionality and experience were very important. In particular, he used an RSS feed to the group to aggregate and keep track of other group members' work. He described his usage of RSS feed in various combinations:

---

[6] 'crawler' is used as a substitute to reserve the confidentiality associated with the tag participant 1 assigned.

> I almost never look at things tagged more than 2 weeks ago. My experience is all about the recent history features accessible and forgettable via the RSS feeds. I've added my connotea bookmark feed to my friendfeed account . Friendfeed is an aggregator for RSS feeds that lets users create personalized aggregate feeds (e.g., blog plus bookmarks plus music listened to on last.fm) and then share their feeds with other users.
>
> The RSS feed to the group provides an easy way to watch what other labmates are doing.

Participant 2

Participant 2 was very systematic in using tags; he used predefined tags that reserve specific words to refer to specific concepts. He seemed to build a cohesive taxonomy with his tag collections, by using general as well as specific topic tags together for most items.

Participant 2 has used Connotea for three years. He used two other folksonomic systems, including CiteULike and Delicious. During the period of study, he reported that "I used Connotea very inconstantly, and switched to CiteULike for sometimes". He was using different folksonomic systems for different purposes and objects. He said:

> I use del.icio.us for tagging bookmarks, even those that have nothing to do with science. I have used CiteUlike for a period, to see if it was better than connotea. My actual opinion is that both lacks all the features I would like to have. In connotea I couldn't read rss feeds from private groups.

Participant 2 used a predefined tagging approach, and developed personal tagging

strategies over time. He had very systematic tag collections that reserved a specific tag for a specific topic. He mentioned it several times in the description of tags in his Connotea diary "I am going to collect all the articles/resources that make use of this topic under this tag".

He usually organized tags in a hierarchical way as he tagged a given item by topics. He assigned tags which indicated general topics as well as specific topics for a certain item. For example, he described the tag 'Tests', indicating it is a "general" topic tag related to his concept of 'genetic test':

> It is a synonym of the tag 'genetic test'; this article describes a test. I used a synonym because I am planning to tag many articles related to genetic test, and this will be a *general* tag *(diary entry #1, emphasis added).*

Participant 2 also assigned as many specific tags as possible, in consideration of findability. He assigned multiple tags, using synonyms for specific items. He assigned an average of 4.2 words per item. When he added specific tags for an item, he usually assigned general and specific topic tags together. It seems that he attempted to build a hierarchical structure with his own tag collections. For example, when he tagged the Web page related to software, he assigned five topic tags together; Genetics software, Population genetics, Software, Structure software, and LD (diary entry #6). Here, it could be inferred that there were two different hierarchical schemes involved with the tags assigned for that item:

Software > Structure Software> LD (it might be classified by tool); and Population genetics> Genetic Software (it might be classified by disciplines).

Participant 2 thought topic tags the first most useful, and task-organizing tags the second most useful for personal information management purposes. Even though, he said, he had not perceived it until completing the study, he marked refining tags as the third most useful for personal information management purposes. In terms of social sharing purposes, he thought topic tags were the most useful, and tags identifying qualities or characteristics were the second most useful, and refining tags were the third most useful. He said:

> A [topic tag] is like when you use keywords on pubmed to search articles. E [quality tag] is useful to know which are the best articles, and which are those that it is not worth to read. D [refining tag] is better if categories are well defined.

Participant 2's motivation targets himself as well as others. He kept his entire set of references public for anyone to see. Participant 2 had a strong sense of perceived quality of tags. He mentioned "wrong tags" twice in his Connotea diary study to refer to tags he thought were not useful and relevant to describe the item (Participant 2's Connotea diary entry #3, #10). In the diary, he reported:

> This tag is wrong. I should not have used it. It is just because I heard about it in a seminar from a genetics group that I have used it *(diary entry #10)*.

Later, he explained that he recognized specific tags were wrong, but did not change them.

In the follow-up interview, Participant 2 said:

> It seemed that I added these tags for error. I remember that I was in a hurry when I added them, and I didn't notice that they [had] nothing to do with the article.
> I noticed that they were wrong only when I was filling the questionnaire for the study. However, I didn't have the time to fix them later, neither (*follow-up email on December 1, 2008*).

> It is just because I heard about it in a seminar from a genetics group that I have used it. This article is about automated querying of databases, and it is not particularly related to genetics. Maybe a better tag could have been genomics. However, it won't [hurt] me to keep this tag on this article, so I won't change it, at least unless I will read the article again (*follow-up email on December 1, 2008*).

He went on saying:

> This article describes a bioperl module. There is nothing of python or biopython there. However, as for before, this tag won't hurt me here. I can leave it there and maybe next time that I will look for all the articles related to biopython, I will remove it (*follow-up email on December 1, 2008*).

Participant 3

Participant 3 was very systematic in using tags; he seemed to build a cohesive taxonomy with his own tag collections, by using a predefined set of tags to classify his bookmarks. He would tend to choose tags from his personal tag cloud, which was built on tags he had used previously, and use them very consistently.

Participant 3 has used Connotea for seven months. He was also using different

folksonomic systems, Delicious and Flickr, during the study. He commented on the purpose of Connotea:

> Social tagging system is very useful to sort each resource into some categories. We can find good resources on the Internet and there are tons of good or bad information. However, it is hard to remember why some resources were good and bad. Tagging or social tagging systems help people track with their information.

Participant 3 used a predefined tagging approach, and developed his own tagging strategies over time. He had very systematic tag collections that addressed a specific tag to plan use for a specific topic. He assigned an average of 4.6 tags per item. He usually tagged a given item by topics, based on its content. He described his general tagging process: "1.think about the most important keyword; 2. think about other related keywords; 3. use tags that I used before 4. see suggested words".

Participant 3 did not perceive a difference between personal and social purposes of tagging. He thought topic tags were the most useful approach for personal information management as well as for social sharing purposes. Regardless of the different purposes of tagging, format tags were rated as the second most useful, and task-organizing tags as the third most useful. He said:

> I use both A [topic tag] and B [format tag] but A is better for me if I need to use just one…For me, topics and themes are the most important factors.

I don't recommend any resource to a person who is not interested in the topic. The resource could be great but it is not when it does not intrigue the person.

In terms of task-organizing tags, participant 3 identified the function of the bookmarked item such as 'share', 'annotate', 'test', and 'highlight'. For example, he tagged a given item about a collection of videos; he used a specific word 'share' as a tag to describe "(its) main function is sharing videos".

When participant 3 tagged a given item, he preferred to use the feature, 'Recently used tags', which refers to his existing tag collections based on tags he previously used. In addition, he frequently used the feature, 'Related tags', which refers to tags assigned to the same resource by other users or ones generated from other sources such as automatically gathered contextual metadata.

Participant 3's motivation targets himself as well as others. He reported that he kept some set of his references public, and others private; however his Connotea diary study observed that he kept his all references public during the seven-day period of study. Participant 3 had a strong sense of publicness in tagging. He understood that others could possibly benefit from shared resources and tags through Connotea. He appreciated the social aspect of a folksonomy which added a social incentive to tagging.

Participant 3 tended to believe that if he tags a resource he's interested in, then he's helping others who share similar interests to find it. He commented on these social aspects and public values of tagging in various combinations:

> I don't collect resource randomly. I think people with common sense may put the name or theme in a similar way.

> People tag information based on their interest so they may tag similar resources. I could find some good resources from others' collections after I accessed others' connotea collection.

He tended to keep the public view in mind when he assigned tags. For instance, he addressed the reason that he renamed the tag, 'networking' by 'socialnetworking' in the follow-up interview:

> I would make it more specific, in consideration of the potential of sharing with others. I wanted to reorganize all related items under the tag of socialnetworking so that others could also find it more easily.

Participant 4

Participant 4 was a relatively new user of Connotea. She began to use Connotea very recently, and was getting to know about Connotea. At the time the study was conducted, she worked as a part-time reference librarian. She had experience with other folksonomic systems such as Delicious and Google Bookmarks. She selected Connotea as a repository

to save references related to her work and class project. She gave her general thoughts on Connotea:

> After entering a few references, I began to think that this was good system for collecting references and then for being able to find [them] via a tagging system. However, and I might have missed something, none of the references showed the authors, nor any of the components for citations - so one has to enter them manually on the citation form right from the start, or click on the reference for bits and pieces for the citations if one wants to create a full citation later. Again though I may not have discovered the tricks for getting some of these bits and pieces recorded automatically.

Participant 4 used a descriptive tagging approach. She tended to describe various aspects of a given item using multiple tags. Her diary studies revealed that she used a number of topic tags and refining tags in order to describe an item as specifically as possible. Since she recently began to use Connotea, she was found to develop her tagging strategies over time. About the process she usually followed when she had an item to tag, she observed:

> I would indicate whether source came straight off a website or was a journal article from the university's data collection, or the project (XXX[7]) or class name XXX. Over time, the number of tags could become a problem - one might be scanning a very long list of tags to get to source - but maybe there is a way of organizing tags too. Sometimes you forget what the tag refers to.

Participant 4 did not distinguish different types of tags, dependent on the purposes of

[7] In cases where giving the participant's tag might compromise anonymity, the tag has been replaced with an alternate or with 'XXX'.

tagging. She reported that she thought topic tags were the most useful for personal information management purposes as well as for social sharing purposes. Regardless of different purposes of tagging, she thought refining tags were the second most useful and task-organizing tags were the third most useful. She said:

> A "topics" tag for me is the most basic way of organization in the context of academic study. Tagging the reference with "Student Retention" tells me that activating that tag will produce the references that I used (or a student for whom I found the article) for this subject. "Health" would tell me that I will get the health references verses those for student retention. Note: that my next most used tag type would be D [Refining tags] - the only reason I didn't select this one as most used is because one needs a Category (Topic) first before refining it (this is how I interpret using these two tags).

In terms of task-organizing tags, Participant 4 presented different ways to indicate which kind of tasks were relevant to a given item. She tended to use a predefined tag to represent items related to her task. For example, she used a specific word ‘reference question’ as a tag to indicate that an item was related to her reference work. She also used reference tags which indicated a specific group of students whom she worked with. In addition, she always added a date-specific tag which was, she said, the date for finding out what bookmarks she entered on a particular day.

Likewise, it is plausible that Participant 4’s tagging would target only herself. She primarily used tags to manage her personal information even though she kept her entire set

of references public for anyone to see. During the five-day period of study, she showed a low degree of interactivity. She reported that she rarely used the Connotea features such as Active user, Popular Tags, Tag Names, User Names, Related Tag Names, and Related User Names, although she thought those were useful. She probably was not aware of the social or interactive aspects of Connotea yet since she had recently begun to use it.

Participant 5

Participant 5 was very systematic in using tags. She used predefined tags since she planned to use a specific word to refer to a specific concept, and she provided an organized set of strategies with consistent format and methods of tagging.

Participant 5 has used Delicious since October, 2005. She was using Delicious very frequently. During the six-day period of study, she reported that she used Delicious more than twice a day. She was using Delicious as the primary repository of her bookmarks though she had used many different folksonomic systems including Connotea, CiteULike, Flickr, BlinkList, and Library Thing. She was aware of the purpose of folksonomic systems in general, and knew Delicious in particular very well. She pointed out five different purposes of Delicious:

> Finding sites I've seen before; source list for research; seeing what's new that other people I follow tag; sharing links with friends; keeping others in my field up to date; [and] sharing knowledge.

Participant 5 used a predefined tagging approach, and developed a set of strategies with consistent format and methods of tagging. She defined a set of tags which represent the main topics of her resource collections, and organized them very systematically. She used as many specific tags as possible, in consideration of findability. She assigned an average of 4.3 tags per item.

In participant 5's Delicious diary, a set of tagging strategies was identified. In general, she defined particular tags based on her anticipated usage, and combined multiple tags in order to describe a bookmarked item specifically. For example, when she added a bookmark about health information-seeking behavior of consumers, she assigned six tags; Report, Consumer, Health, Search, Information, and Behavior. In her Delicious diary, she described the reason why she used those tags and the way she specified a given item:

> Report: it's a report (format)
> Consumer: part of my consumer health tag (because other health stuff about non-medical personal is tagged with consumer health)
> Health: part 2 of my tag to describe consumer health
> Search: my catch-all tag for search-related topics
> Information: part of a 2 part tag information behavior. Report is about information behavior of consumers' seeking health information
> Behavior: part 2 of information behavior tag *(diary entry #2).*

Likewise, Participant 5 tended to have a very strict rule for using tags. About the general process that she usually followed, she commented:

> If it's from a certain source, I'll always tag it with an in:XXXtag. If it's a journal or magazine article, I always use article as a tag. I only use one word tags, unless it is a name (naturepreceedings or searchwiki).

She went on to say:

> I can easily say I want to find all the articles from Library Journal about social bookmarking by combining these types of tag: social+bookmarks+article+in:libraryjournal. It makes it really easy to find stuff again no matter which way I remember it—topic, format, or source.

These tagging strategies also were related to her perception and usage of types of tags. Participant 5 thought topic tags were the most useful approach not only for personal information management purposes but also for social sharing purposes. Regardless of the different purposes of tagging, source tags were rated as the second most useful, and format tags rated as the third most useful. Regarding the source tag, she distinguished two types of sources by using the format of 'in:XXX', and 'via:XXX', which refer to the source of the resource she'd accessed. In addition, she was using a special tag in the format of 'for:XXX(username)' to send links to another Delicious user.

Participant 5's motivation targets herself as well as others. She kept some set of her references public, and others private. She was using Delicious as a way to communicate

with other users who worked in her field through its network features. She was engaged with one network on Delicious. She thought that the network formed an important part of her Delicious experience. She reported that she collaborated on the creation of reference collections with other Delicious users by "using the tags and watching [her Delicious] network".

Participant 5 appreciated her experience of her Delicious network, saying:

> I can see what other people are bookmarking, and they can see what I am bookmarking—sharing knowledge. It means you don't have to stay on top of every source when you trust someone in your network to help you find stuff you may have missed. For example, one of the people in my network bookmarks good stuff from Lifehacker, so I just watch her instead of subscribing to Lifehacker myself.

Participant 5 thought most Delicious features, such as Popular bookmarks, Popular tags, Tag names, Usernames, and Everyone bookmarks for this Web page, were useful to discover items interesting to her. In particular, she preferred to use the feature, 'Everyone bookmarks for this Web page' which showed the user what people thought about this site she'd bookmarked. She commented on this feature:

> This is extremely useful. You can figure out what people have to say about your work, what people have to say about resources you're not personally invested in, and you can figure out who has the same interest as you.

Participant 6

Participant 6 has used Delicious since August 2007. She was using Delicious very frequently. During the period of study, she reported that she used Delicious more than twice a day. She was using Delicious as the primary repository of her bookmarks among other folksonomic systems she was using, including 43 Things and Flickr.

Participant 6 used a descriptive tagging approach. She tended to specify a given item very descriptively using multiple tags. Statistical analysis showed that she used an average of 4.3 tags per item; however, it was observed in her Delicious diary that she assigned more than five tags for several items. She tended to describe various aspects of a given item as specifically as possible. She used a number of topic tags and refining tags, in order to specify various aspects of a given item in her Delicious diary.

Participant 6 also attempted to represent an associative relationship with a given item by specific tags. Her Delicious diary study showed that she frequently assigned multiple tags in order to describe associative relationships with an item, such as ‘a facet of’ ‘features’, ‘inspired by’, ‘contains in’, ‘links to’ or ‘marginally related to’. It was also observed that she commonly used refining tags to specify geography and time related to a given item. For example, when she added a bookmark about Rick Roll, she assigned six

tags and described why she used those tags as followings:

> Videos: this bookmark is a video
> Youtube: this bookmark came from youtube.com
> Rickroll: this bookmark features Rick Astley's "Never Gonna Give you Up"
> Thanksgiving: this bookmark was created on Thanksgiving Day
> Awesome: this bookmark is awesome in my opinion
> Internetculture: this bookmark shows a facet of Internet culture *(diary entry #14)*

In addition, Participant 6 assigned tags based on which kind of search she anticipated using. She would always keep the possibility of refinding and reusing a bookmarked item in her mind when she assigned tags on a given item. For this reason, she used the tags identifying qualities or characteristics as well as topic tags a lot. About the process that she usually followed when she had an item to tag, she said:

> I think of what criteria I would think of when searching for this item again. Would I think of it as funny, or related to a certain site or related to a certain theme or geographic region? If the answer to any of these questions is yes, I tag the item as such. Sure, I have many, many items tagged as 'funny' or 'humor', but such is life.
>
> I tag on a whim based on what I think will be useful in the future.

Participant 6 thought topic tags were the most useful for personal information management as well as for social sharing purposes. However, in terms of personal information management purposes, she thought that source tags were the second most useful, and format tags were the third most useful. On the other hand, in terms of social

sharing purposes, she thought that tags identifying qualities or characteristics were the second most useful, and source tags were the third most useful. She said:

> if people are going to click a link, they want to see what's it about and what emotions the contents of the link will evoke before discovering whether it's a book or list or whether someone intends to read it later.

Participant 6's motivation targets herself as well as others. Regarding the way she kept her bookmarks in Delicious, she distinguished between collections private to her and ones to share with other users very clearly. She said "I keep almost all my bookmarks public except for those that are only useful to me, such as my school's email website and related websites".

Participant 6 appreciated the social and interactive aspects of Delicious very well. She observed and was affected by others' bookmarks and tags. She presented her perceptions of social aspects of Delicious in various combinations:

> I believe that Delicious is a website that allows users to share interesting websites that they've found with others. During my time at Delicious, I've discovered many interesting pages through the home page that I otherwise would not have discovered. This social aspect though hidden, is what makes Delicious a social bookmarking site.

> Delicious allows users to access and share information quickly and detect trends and interesting sites easily as these sites are often the ones that pop up on the home page.

In particular, she preferred to use the feature of Everyone bookmarks for this Web page: "I

like seeing other people's reactions, especially if they mention a feature of a site that I haven't noticed yet". Among Delicious features, she used this feature the most frequently (her Delicious diary study showed that she used this feature 15 times among a total of 40 entries). Participant 6 also appreciated serendipitous discovery of information through the features of Popular bookmarks, Popular tags, Related tags, and Everyone bookmarks for this Web page. She used those features in tagging, and thought them useful to find related resources.

Participant 7

Participant 7 was very systematic in using tags. He used predefined tags in order to use a specific word to refer to a specific concept as well as to provide an organized set of strategies with consistent format and methods of tagging. Participant 7 has used Delicious for eight months. In an interview session, he reported that he was using Delicious once a day, and put a large amount of his time to work with it. At the time of the study, he was using Delicious as the primary repository of his bookmarks, and had no experience with other folksonomic systems.

Participant 7 used a predefined tagging approach, and developed his own tagging

strategies over time. He planned to use a specific word to represent a specific concept in advance, and used a set of predefined tags very consistently. In addition, participant 7 attempted to develop a cohesive taxonomy with his tag collections. He tended to assign a tag, keeping a hierarchical structure in mind prior to tagging. He commonly organized tags very systematically based on his anticipated usage and content.

Participant 7 reported that he established his own tagging strategies through several trial and error processes:

> I have deleted my account several times, and only recently removed all my bookmarks and started again. Why? Because I wanted to reduce the number of bookmarks and alter the way I tag to see if that was better.

Regarding his tagging strategies, he addressed how he organized his tags and represented the breadth of subjects using tags. He developed tag bundles[8] in order to represent generic top-level categories, which consist of a series of generic tags and specific tags at a lower level. He described his strategies to represent the breadth of subjects of a given item:

> I use bundles as folders and then have key tags that act sort of like subfolders. Development bundle would be a folder, and as key tags (sort of like sub folders I have things like php, javascript, etc.). Anything I can then find anything to do with php by clicking the tag and then refine the tag by clicking on related tags: php -> patterns or typo3 -> extensions -> manuals. I do this because otherwise all kinds of crap ends up under a tag that has nothing to do with the bundle. If

[8] A tag bundle is a group of related tags users can use to organize their personal tag collections in Delicious.

> [I] have a bundle called development and a tag in it called javascript I could also put there events for javascript events, but things like holidays and parties would show up there too, even though it has nothing to do with javascript. So now instead of listing all tags under development, for example), I just list key tags and refine my search.

However, he found it difficult to specify a given item by breaking down each specific tag and then grouping all related bookmarks in one place as he anticipated. He commented on this:

> I have also tried making huge long tags, like giving a bookmark the following: javascript, javascript_events, javascript_events_mouse and so on, but it becomes impossible to read because of so much duplication. I have this problem with my current bookmarks. I have forums as a tag, and some forums I bookmark as being applications or development. Great I can find my bookmarks for software forums easily now, but when I click applications under the software bundle I see all the forums too, when all I want to see is software applications. Makes bundles a bit pointless.

In terms of issues involved with control for plurals in tagging, he said:

> Also deciding whether to use plural or singular forms of words is difficult, but I always make sure that I stick to one form, I never use both. Deciding between german and germany is difficult sometimes I need both but I don't want two tags, so anything that is german, or in the german language uses germany, even if german would be better.

Participant 7 perceived different types of tags to be useful, depending on the purposes of tagging. For personal information management purposes, he reported that he thought topic tags were the most useful, refining tags were the second most useful, and reference tags were the third most useful. In terms of social sharing purposes, he thought that refining

tags were the most useful, format tags were the second most useful, and the tags identifying qualities or characteristics were the third most useful. However, despite his perceptions about different types of tags, he seldom distinguished between his personal information management and social sharing purpose in using the types of tags. Study of his Delicious use showed that he most often used topic tags, addressing the breadth of subjects associated with a given item, in order to carry out his personal information management purposes.

Therefore, it was plausible that Participant 7's motivation was primarily targeted to himself. In his interview session, he remarked that he would not consider others' tags and resources nor social aspect of Delicious. However, during the study, he was found to form some perceptions of other users. He reported that he kept some of his bookmarks public and others private; however, his Delicious study showed that he shared all his bookmarks with others during the 11-day study period. He was even observed to add a specific tag in consideration of others' searching. When he added a specific word "green" as a tag to represent "vert[9]", he said: [vert] "doesn't exist in English, so I give it something to help me find it or *for others"* (*diary entry #7, emphasis added*). He also reported that he

[9] "vert" is used as a substitute to reserve the confidentiality associated with the tag Participant 7 assigned.

occasionally liked to observe others' comments for a bookmark he'd added, particularly through the Delicious feature, Everyone bookmarks for this Web page.

In terms of other Delicious features, Participant 7 did not perceive their social components at any time even though he reported that he occasionally used some Delicious features including Popular bookmarks, Related tags, and Everyone bookmarks for this Web page. He tended to use those features to refine his own tags for his personal information management purpose, without any perception of social value. About the question whether the feature, Related tags, was useful to him, he answered "in my own bookmarks yes, so that I can refine my display of tags when looking for something."

Also, he had a negative view of the feature, Popular bookmarks:

> Seeing sometimes something useful, or interesting, but it is full of spam, all starting with numbers, like '20 great firefox e[x]tensions you can't live without', '10 online tools you never knew you needed even though you really do'. These are just dull empty blog articles with links to other popular websites. The blog writer hopes they will bring him more traffic by linking to popular firefox extensions. They annoy the hell out of me, so I no longer look or bookmark links from the popular page, but I still sometimes follow other popular links. Also there is always a high number of geek links there, it's nearly always have made up of computing and web development links which doesn't do much to encourage non-geeks to join delicious.

In general, Participant 7 tended to tag for personal use with sufficient consistency in order to allow aggregation in a useful way. He did not appreciate the network features of

Delicious at all. He commented:

> The purpose of del.icio.us is to allow people to use the same bookmarks wherever they are. They claim it is social bookmarking, but I fail to see anything social about it. Maybe to geeks being able to see what other peoples bookmarks (or not as the case maybe with private bookmarks) is social, but that's probably because they spend too long on a computer and don't have any real social contact. I use delicious because I want to display bookmarks on my website that have some relevance with the blog or portfolio piece being seen. I couldn't care about the network option and subscription services. I have no time or desire to use them. Adding someone's name to my 'network' and seeing what they bookmark requires that I know other people who use delicious, since I don't and delicious is too geeky for them to use anyway (if they have ever even heard of it) *these so called 'social' aspects of delicious are of no use to me*. If I want to share a link I send it via email to the people I know who may be interested (Participant 7, emphasis added).

Participant 8

Participant 8 has used Delicious since 2004. He had experience with other folksonomic systems including CiteULike, Flickr, bibsonomy, and magnolia, though he was using Delicious as the primary repository of his bookmarks. He commented on the strengths of Delicious, “Easy to use, no-frills. Location agnostic bookmarks; easy to recover link archive; Discoverable, human edited archive”.

Participant 8’s tagging approach varied with each item, depending on the way he accessed the item. Through the Delicious features such as ‘Network’ and ‘Subscription’, he

collected other users' latest references that he was interested in, and watched what others were bookmarking about his interesting topics. He usually tagged a given item by topics, using many specific tags. He used as many specific tags as possible, in consideration of findability. He assigned an average of 4.5 words per item. Participant 8 attempted to build a cohesive taxonomy with his own tag collections. He tended to use tags from his own tag collection very consistently. He reported in describing his tagging process that he selected appropriate tags from his own tag cloud first. If he couldn't find any appropriate tags from his tag cloud, then he created four to six new tags relevant to a given item. His Delicious study observed that he most often used recommended tags which Delicious provided when he assigned tags. During the seven-day period of study, 47 were tags recommended by Delicious of a total of 50 tags which he assigned.

Participant 8 perceived different types of tags to be useful, depending on the purposes of tagging. Regardless of tagging purposes, he thought topic tags were the most useful. For personal information management purposes, he thought task organizing tags were the second most useful and tags identifying qualities or characteristics were the third most useful. In terms of social sharing purposes, he thought format tags were the second most useful, and tags identifying qualities or characteristics were the third most useful. He said:

> A [topic tag] is a must to define a resource B [format tag], E [tags identifying qualities or characteristics] can be useful for a casual surfer searching for some entertainment content F [self-reference tag], G [task organizing tags] are not opinions but are more contextual fact for a single user so they are less useful for other people.

Participant 8's motivation targets himself as well as others. He kept his entire set of bookmarks public for anyone to see. He was very aware of social and interactive aspects of Delicious. He appreciated the Delicious features as a channel for discovery of interesting information and related resources. His Delicious diary showed that he was affected by others' bookmarks and tags. It was observed that he copied bookmarks and tags from others' collections four times during the seven-day period of study. He also preferred to use recommended tags. In addition, Participant 8 was found to use the network features of Delicious including 'My network', 'Subscription', and 'Popular bookmarks' very frequently in tagging.

Participant 9

Participant 9 has used CiteULike for six months. He was also using different folksonomic systems including Delicious and Flickr at the time of study. He was aware that different folksonomic systems dealt with different purposes and information objects. He

reported:

> The other systems are not alternatives. For instance del.icio.us is for tagging bookmarks, flickr is for tagging photos. So why would I choose to stop using flickr because I have started using delicious? I use del.icio.us because I bookmark a lot of URLs. I don't store photos online, so I don't use flickr.

Participant 9 was using CiteULike as the primary tool for sharing his resources with colleagues and his students. He was using CiteULike in the academic context where he collected resources related to his research project and class, and referred them to his colleagues and students in class. In terms of class related resources, he was using class-specific tags identifying the resources to share with students who took his specific class, with assigning the tag which started with "classXXX".

In general, Participant 9 used a predefined tagging approach. It seemed that he developed his own rules for using tags. He defined a set of tags to represent a specific topic, and organized them very systematically. He tended to choose tags from his personal tag clouds, based on his planned usage. There was no grammatical variation found in a given tag.

He reported that he used as many specific tags as possible, in consideration of findability. Statistical analysis showed that he assigned an average of 2.9 tags per item. He was using multiple tags, including synonyms and acronyms for several items. For instance,

when Participant 9 tagged an item about software-defined radio, he assigned two tags to specify a topic of SDR (software-defined radio): ‘sdr’and ‘cognitive-radio’ which is a synonym of SDR (diary entry #3).

When he added a new tag for an item, he usually classified it by topics. He thought topic tags were the most useful for personal information management purposes as well as for social sharing purposes. He said “I mainly share items with other people because they are interested in the topic.” Participant 9 cautioned that most other tag types were likely to be redundant with the fields which CiteULike provided as the default. He said:

> Most of the other tag types seem redundant. For instance, “identifying who owns it” is unnecessary since there is already an author field.

Participant 9’s motivation targets himself as well as others. He kept some sets of references public, and others private. He was very aware of the social and public values of CiteULike in particular, and folksonomic systems in general. It is plausible that Participant 9 would use tags as a way to communicate with other users who have similar interests. He understood that other CiteULike users possibly communicate with each other through tagging. In his CiteULike diary study, he described the reason why he was tagging an item: “sending a pointer to this paper to one of my PhD students” (diary entry #2, 3).

Participant 9 was using most features of CiteULike to refine his search for relevant

resources. About Tag names, User names, Related tags, Find related articles with these CiteULike tags, and Find related articles from these CiteULike users, he said that he was using those features as a "mechanism for constraining searches". He thought those features were useful to narrow down his search so that he could find more relevant resources.

Participant 9 was engaged in one group in CiteULike. He thought the group functionality and experience were very important. Using an RSS feed and task specific tags, he collaborated on the creation of reference collections with other members of his group. He also said that CiteULike needed to offer much more functionality for group communication.

Participant 10

Participant 10 has used CiteULike for three months. She reported that she chose CiteULike over Connotea because of the speed and ease of use, saying "(CiteULike provided) excellent and responsive customer support and uncluttered intuitive interface". She continued, "CiteULike is a huge blessing for my scientific well-being. It keeps me organized and on top of news and views in science". On the other hand, she pointed out the weakness of CiteULike:

> Missing plugins for many sites; non-existence of a write and cite/ cite while you write/ live writing plugin for document authoring; and inability to share PDFs within groups (if groups are public).

Participant 10's tagging approach varied with each item and purpose of tagging. She commonly added new tags relevant to her research project. About the process that she usually followed when she had an item to tag, she said:

> I tag items according to their relevance to my many projects- their place of citation (or the section they are going to be cited in my final document)- common thread of ideas they represent – big ideas they represent- commonality with other articles in my library- groups in which they are shared- subject to which they belong – their relevance to my studies.

Likewise, she assigned tags based on her anticipated usage and planned needs. She defined a set of tags which represent a section of her thesis in advance, and used them very consistently. For example, she was using a specific word, 'new-direction', as a tag to represent items which would be used in the background section of her thesis, and 'thesis' for ones to be used in these references.

Participant 10 was very aware of the function of tags and distinguished different needs of tagging between personal information management purposes and social sharing purposes clearly. She claimed refining tags were the most useful regardless of the purpose of tagging. In terms of personal information management purposes, she claimed topic tags were the second most useful, and task-organizing tags were the third most useful. She

commented on the tags for her personal information management purposes:

> [tags should] help me group and sort my references easily; help me locate them easily; help me export them easily; keep all references neatly categorized; and help me digest information easily.

On the other hand, in terms of tags useful for social sharing purposes she preferred task-organizing tags over topic ones, saying:

> The people with whom I am sharing references collaborate with me on specific projects as sub-categories are very helpful, so are tasks and topics. Tasks usually indicate which group of people I share my articles with.

In fact, it was observed that Participant 10 used a number of task-organizing tags as well as topic tags, whereas she rarely used the tags identifying qualities or characteristics.

Participant 10's motivation targets herself as well as others. She was engaged in one user group in CiteULike which was related to her research institution. She thought the group functionality and experience were very important. She was collaborating on the creation of collections of references by sharing her references with other members of her institution. She said, "We bookmark, share, and discuss reference at office meetings. We collaborate and brainstorm new ideas in the field via reference discovery."

She presented a set of group-related tags, specifying her group name which represented common themes with the group she belonged to and resources to share with that group.

Participant 10 also had a strong sense of the navigation function of tags which led her

to discover and explore new topics of interest through CiteULike features: Everyone's library, Everyone's tags, Tag names, User names, Find related and Find related articles from these CiteULike users, Related tags, and Find related articles with these CiteULike tags. She thought all features were useful, although she said that she did not know two latter features existed until the study (Related tags, and Find related articles with these CiteULike tags).

Participant 11

Participant 11 was very sophisticated in using the folksonomic systems and tags. He was actively engaged in sharing his thoughts with other users through the CiteULike forum. He was encouraging the use of additional networking features of CiteULike, such as CiteULike Forum Feed and News Feed, to explore recent features and issues. He preferred to get RSS feed updates on newly posted articles from his CiteULike neighbors or their tags. In particular, he reported that he installed SyncUThink, which is an automated program for fetching and storing PDFs from a personal CiteULike library.

Participant 11 has used CiteULike for three years. He reported that he had used Furl before but stopped using since "(Furl) was not much faster than simply searching the web for the

page a new". He commented on the purpose of CiteULike as follows:

> The stated purpose, as I understand it, is to bring a social aspect to reference management. My purpose, on the other hand, is to manage my reference library. I do find it interesting to follow what related researchers (defined by my CiteULike neighbors) are reading (I subscribe to their feeds). However, the most valuable aspects of CiteULike for me are: 1) the browser bookmarklet that quickly gets a new reference into my library; and 2) the fact that my references, and associated PDFs, are stored centrally and that I can access them from anywhere.

Participant 11 used a predefined tag approach. He defined a specific tag based on his anticipated usage in advance, and used it very consistently and systematically. He commonly chose tags from his own tag collections, without considering others' tags. About the process that he usually followed when he had an item to tag, he stated:

> I think about each tag in my tag cloud and ask myself if this article is primarily "addressing" that subject. As there is no point-and-click I also have project-related tags, for projects that I am currently working on. If a paper is relevant to the project, I also give it the project tag. These tags are all prefixed with "proj_". (These personal project tags should be private, but I do not believe such a feature exists). I also have institute/lab tags, to tag papers from certain research institutes/research groups. These tags should 1) be private and 2) not actually be necessary because the institutes should be extractable from the article's meta-data.

In terms of types of tags, Participant 11 understood and distinguished different types of tags, depending on the purposes of tagging. For personal information management purposes, he thought task-organizing tags were the most useful, self-reference tags were the

second most useful, and format tags were the third most useful. He said:

> The purpose of my library is to make it easy to search for papers and to read them and cite them when I am writing an article. This is why a more task-oriented or project-oriented approach is most relevant for managing one's personal library.

On the other hand, for social sharing purposes, he thought topic tags were the most useful, and refining tags were the second most useful. He also suggested that other types of tags which could tell him about the person posting the article were the third most useful tags for social sharing purposes. He said: "(I would) need to know something (user profile) about the person posting the article (e.g., are they very active in a field related to my own)". He went on, saying:

> The personal project-related and task-related tags are clearly not relevant to others. Primarily subject categorization is relevant here. Attributes and characteristics may also be relevant, but these are very subjective and require me to first trust the person sharing/posting the article. For this reason, when another person posts, it would be interesting to have quick access to their profile, their history of posts, and also where they are one of my neighbors (i.e., have a library that overlaps my own, to some extent).

Participant 11's motivation targets himself as well as others. He had a very strong sense of the publicness of tagging, commenting on it:

> I never post any private references. I do create private notes that remind myself why I posted the reference. I almost always post all references to the private group I belong to (colleagues at my institute).

However, he had a negative view of CiteULike features which led him to find related

information. He reported that he preferred to use RSS feed updates on newly posted articles from neighbors or neighbors' tags rather than other CiteULike features. He only used tag names and user names among the CiteULike features, which he thought were useful. He presented his suggestions involved with each CiteULike feature as follows:

> Everyone's library: signal-to noise is too slow…My CiteULike profile already contains fields "What I do" and "Interests". The main page should show me articles posted by people who overlap my profile/interest.
>
> Everyone's tag: Like all folksonomies, tags are ambiguous. A possible solution to unifying some tags [is] when adding a tag, provide some kind of auto-complete (a la Google), so suggest popular tags, so that people prefer to re-use established tags. Of course, this should be optional, not forced, i.e., I should still be able to continue typing a tag of my own.
>
> Tag names: Potentially useful, but the problem is, the only time other users use the same tags is when the tags are very generic (i.e., algorithm, review). Finding other "format" tags is not relevant for my research, I need to find other "topic" tags, but these are, as mentioned, too ambiguous.
>
> User names: Once I have identified people of interest to me, I can see what they've tagged and how they've tagged it. The more important step, however, is first finding these people by being able to identify them as neighbors.

In addition, he mentioned the suggested tags which CiteULike provided when he added a new bookmark:

> I do not use suggested tags, because my topic tags are already organised in a way that makes sense to me. *I do not put a large amount of faith into the tags of others, as different people necessarily organise concepts differently*. Moreover,

> no folksonomy groups tags into conceptual categories. For CiteULike this would only make sense if the tag answers the question: what is this article about. But there are other contextual factors, e.g., what project I'm currently working on, that people represent with tags as well (*follow- up interview on December 27, 2008, emphasis added*).

Participant 11 was engaged with two groups in CiteULike which were related to his research projects. He identified these two groups: one as his private research group and the other as a public group. About his experience with these groups, he also reported a different approach to distinguish between a private group and a public group clearly:

> The group XXX is our private research group, intended to post articles, share notes. The other members of the group have tried it out, but I am the only high-volume user. It seems that the workflow: getting an article from a PubMed page, to CiteUlike, to RIS download, to EndNote import, to MS Word citation, is either too cumbersome or too technically involved for many.

On the other hand, he addressed the difficulty of tagging for his public group, saying:

> The group YYY is a public group. I rarely post articles to this group, however, because I always upload a PDF when I post. I see an option to share PDFs, but I do not see an option to say, share this PDF with the one group, but only share the reference with the other group(s). To avoid legal hassle, I simply do not share even the reference with the other group, otherwise I would have post every article twice.

He went on saying:

> I always select "I have the right to distribute this document". This prevents me from ever sharing any of posted references with public groups. I belong to one private group (my colleagues at my own institute) and one public group. I would like to share references with both. But, I am not allowed (legally) to share copyrighted PDFs with the public group. When I upload a PDF, there is

> no way to share it with one group but not with another group. This should simply be another series of check boxes. Right next to check boxes for "Post to:" should also be "Share PDF with these groups:" with another series of check boxes.

Participant 12

Participant 12 has used CiteULike for three months. She was using CiteULike as the primary repository of her bookmarks. She said about the purpose of CiteULike, "[I] preserve my bookmarks about [my research area] and I can take a look for relevant resources to my research." She went on saying:

> The purpose of CiteULike is to allow users to store, tag, and share web sites/articles. I have been using CiteULike since my friend introduced it to me. I wanted to use CiteULike as a repository for websites that interest me. The search feature also allows me to easily find resources on particular subjects. I like finding unexpected resources but related to the subject.

Participant 12's tagging approach varied with each item and purpose of tagging. She commonly added new tags relevant to her research and class. She assigned tags based on her anticipated usage and planned needs. She usually tagged a given item by topic. In terms of class or research related resources, she was using class-specific tags identifying the resources to be used for the class. She assigned an average of 3.4 words per item. She described her general tagging process: "I look up my tag cloud and choose the appropriate ones. If I can't find the appropriate one, then I add a new tag that is needed".

Participant 12 perceived a difference between personal and social purposes of tagging. She thought topic tags were the most useful for personal information management purposes as well as social sharing purposes. In terms of personal information management purposes, she thought task-organizing tags were the second most useful, and format tags were the third most useful. She said:

> A [topic tag] allows me to quickly find all my saved resources on that particular topic. When I find resources related to my research, this is really helpful. I use G [task organizing tag] a lot, too. When I work on my research, I can click on that tag and pull up all the resources related to that task. B [format tag] also helps me find resources quickly because I generally remember resources by types such as books and blogs.

In terms of social sharing purposes, Participant 12 thought refining tags were the second most useful, and format tags were the third most useful. She thought refining tags would help others to locate resources. She said:

> Topics are so specific nowadays in [my research area]. It is hard to find relevant resources. D [refining tag] helps make sense of the other tags… It is easy to deduce that's it's relevant to [my interest].

Participant 12's motivation targets herself as well as others. Regarding the way she kept her bookmarks in CiteULike, she distinguished clearly between collections private to her and ones to share with other users. Her CiteULike diary studies showed that she kept seven bookmarks public and three private of a total of ten bookmarks during a one-week

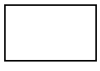
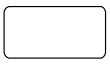
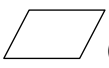
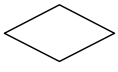
study period. When she kept her bookmarks private, she primarily used task-organizing tags identifying a specific class or research project which she was involved with.

Participant 12 appreciated the social and interactive aspects of CiteULike very well. She had a strong sense of the navigation function of tags which led her to discover and explore resources through CiteULike features. She was using the CiteULike features as a discovery channel of interesting information and related resources. Participant 12 reported that she mostly used the features such as Everyone's tags, Tag names, User names, and Find related articles with these CiteULike users. She thought those features were useful. In particular, she preferred to use the feature, Find related articles with these CiteULike users. She commented on that feature:

> [Find related articles with these CiteULike users] is useful to me. 1) other people may have assigned tags that I hadn't thought of, but would be useful for me to use as well. 2) it leads me to other users who may have similar interests to my own, which will in turn lead me to new resources.

6.3 Tagging process flowcharts of 12 participants

The tagging processes of 12 participants are described by presenting flowcharts[10] based

[10] In this study, flowcharts contain basic symbols:  (process);  (alternative process);  (input);  (decision); (off-page connector); (terminator); and

on the analysis of the qualitative diary studies. Flowcharts illustrate each individual's pattern based on the tagging processes of 12 participants when they classify Web resources, and assign tags to those resources. According to Sauperl (1999), process flowcharts can be used as an intermediary layer of abstraction between the narratives of the participants and the general model. Participants' individual narratives (in Chapter 4.2.2) offer a thick description of details, which can also unintentionally cover the progress of the tagging process of individual participants. On the other hand, flowcharts more clearly present the tagging process by excluding details of participants' reasons for particular processes and decisions, as well as problems associated with them (Sauperl, 1999).

Descriptions of flowcharts and related guidelines for non-standard features were adapted from Sauperl's (1999) study on cataloging processes of the observed catalogers, which attempted to "faithfully represent the observed situation" since Sauperl felt that "any hypothesizing about possible events would be inappropriate" (p.270):

- Non-observed events are noted as such or are represented in a single process, and "uncertain" occasionally replaces "yes" and "no" at decision exits.

---

flowlines in linking symbols:
→ (operation sequence and direction) ⇢ (alternative process and an extended comment to the symbol it references)

- While normally any decision element would have two solutions, decision elements in the following charts can have only one solution, if only one solution was observed. In such cases, the other solution is marked with a note “not observed”, which means that the other possibility did not occur.
- In order to provide a faithful representation of the observed situations, some tasks which might seem to require more detail do not include it when the detail was not observed.

Figure 6.5 Participant 1's Tagging Process: Use of RSS Feed & Extensions

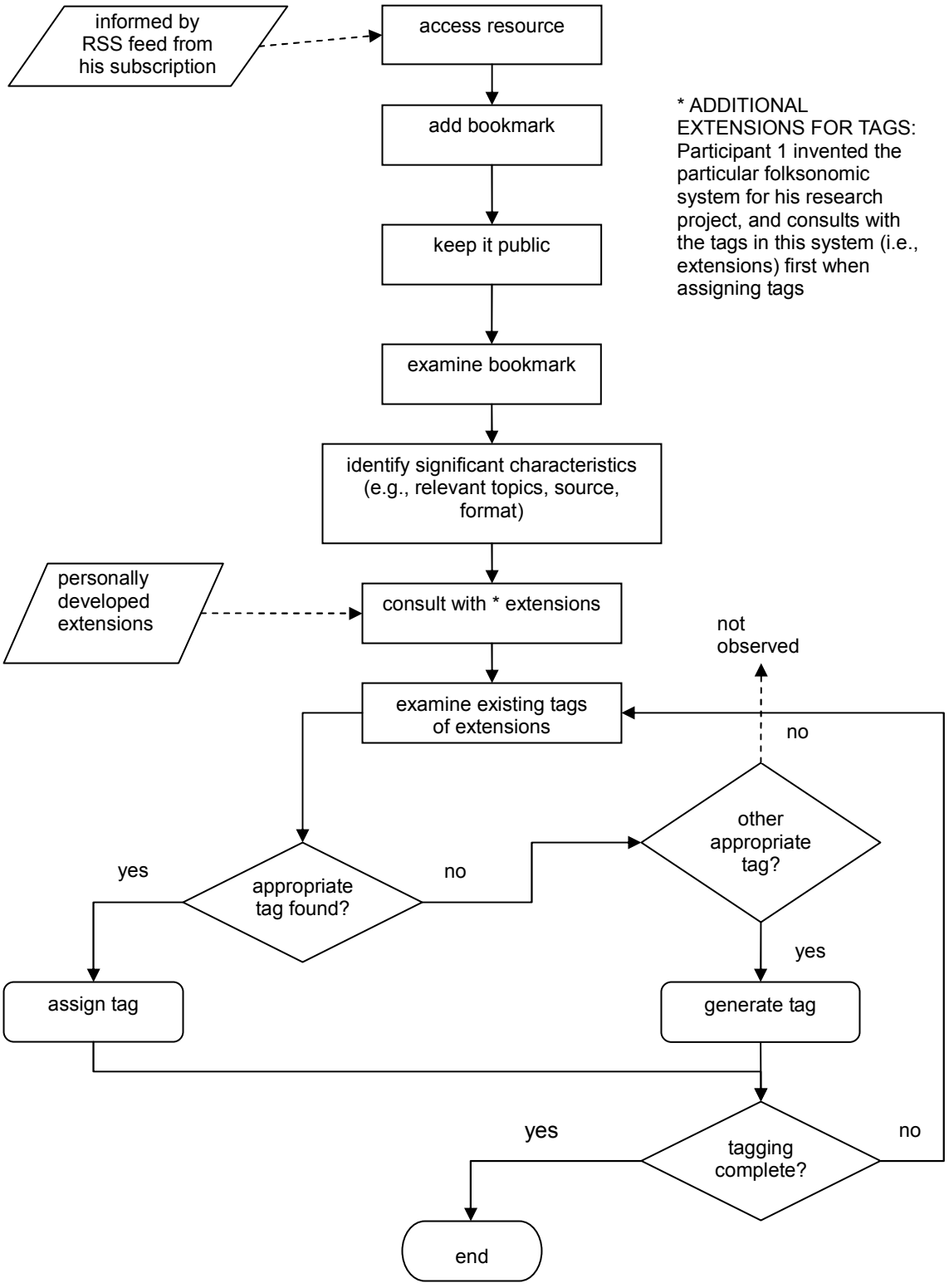


Figure 6.6 Participant 2's Tagging Process: Copying from Others

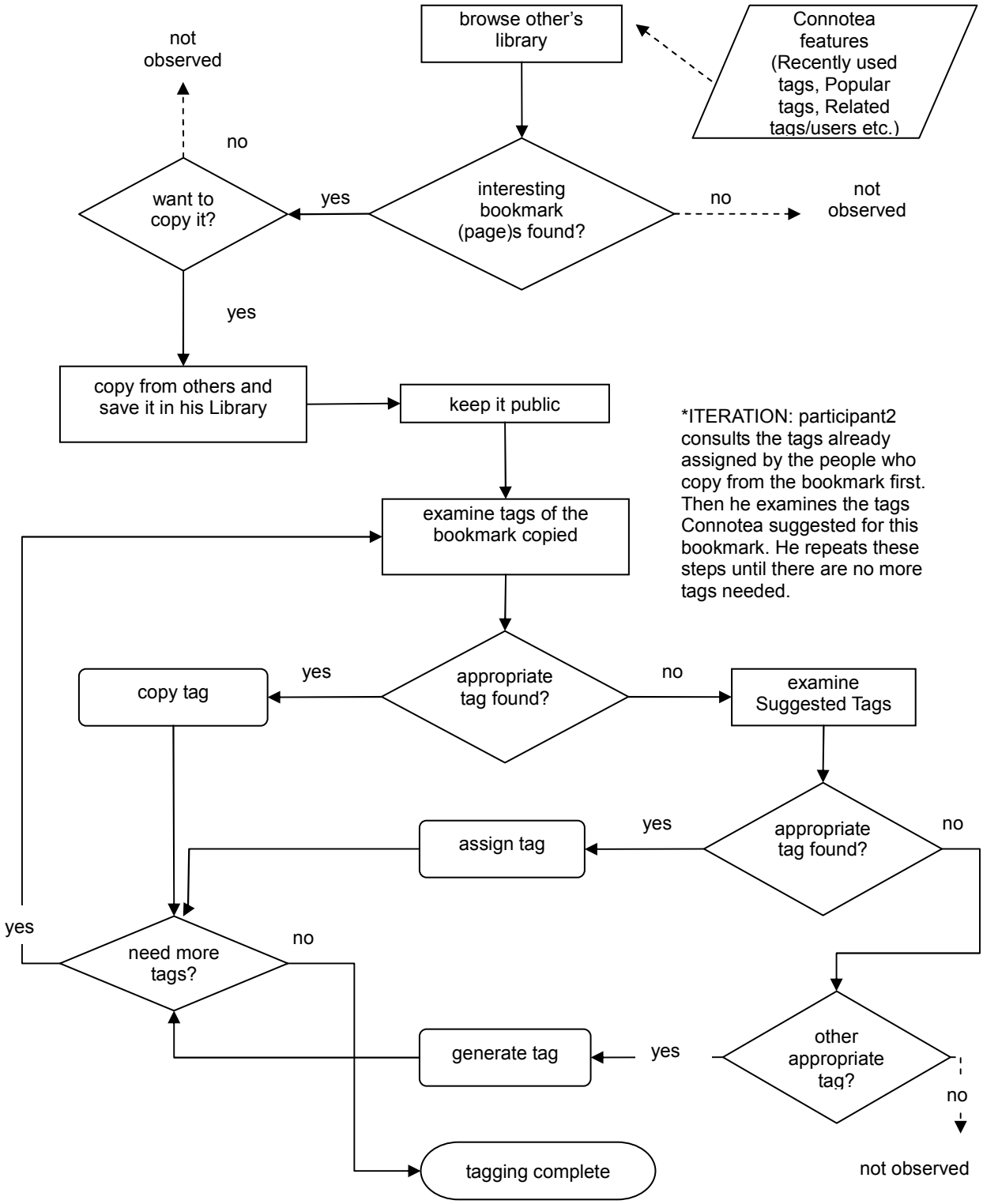


Figure 6.7 Participant 2's Tagging Process: Adding/ Renaming Tags

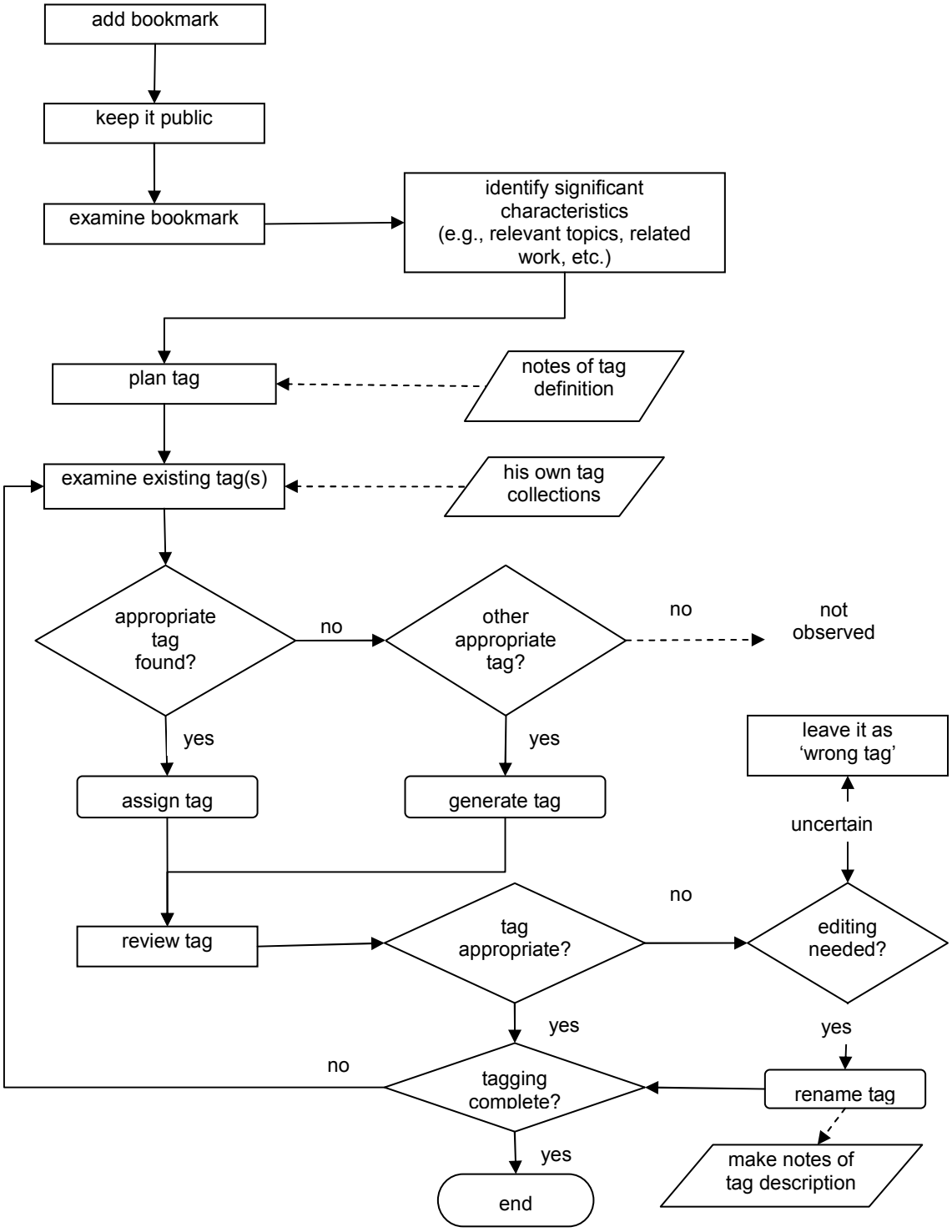


Figure 6.8 Participant 3's Tagging Process

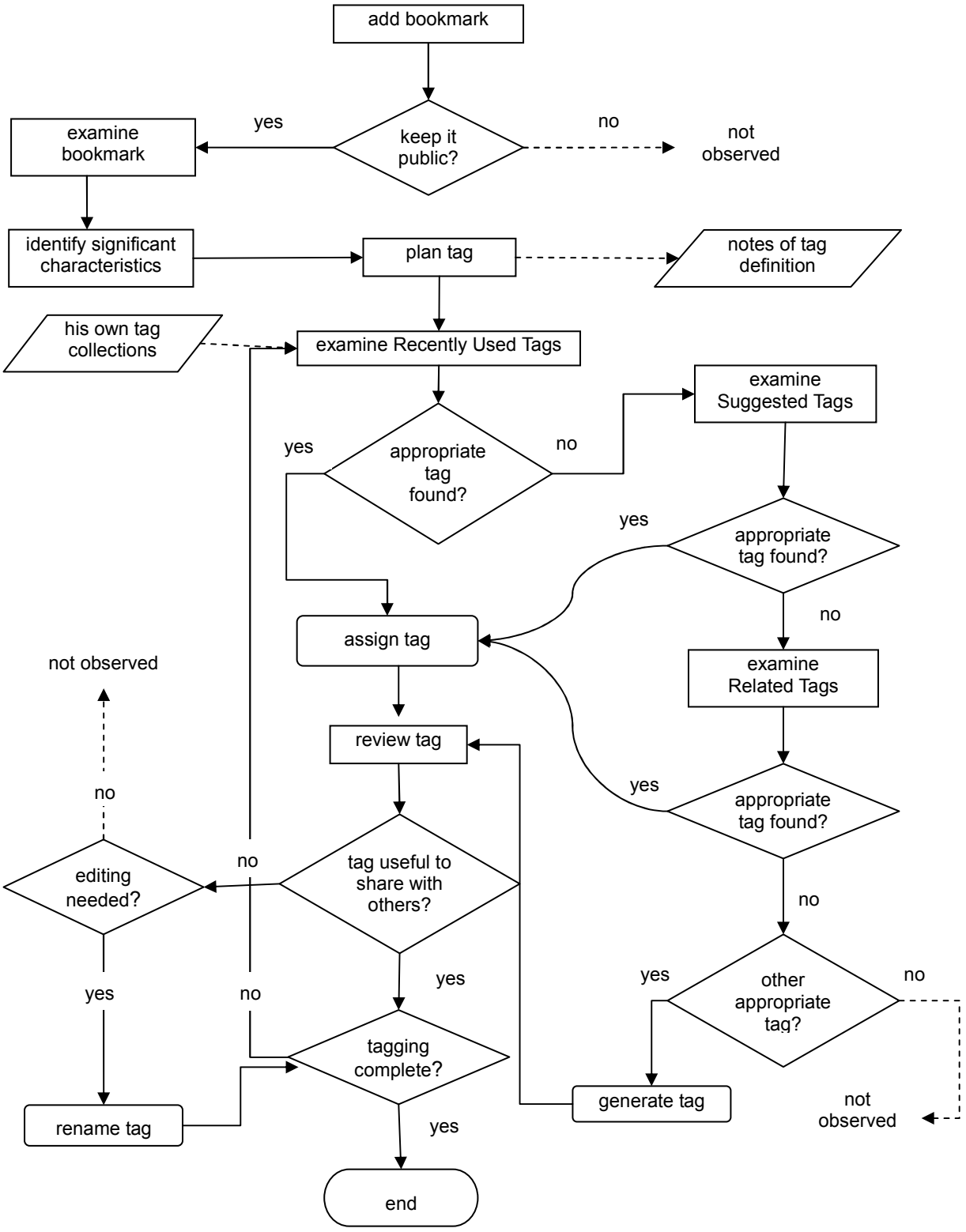


Figure 6.9 Participant 4's Tagging Process

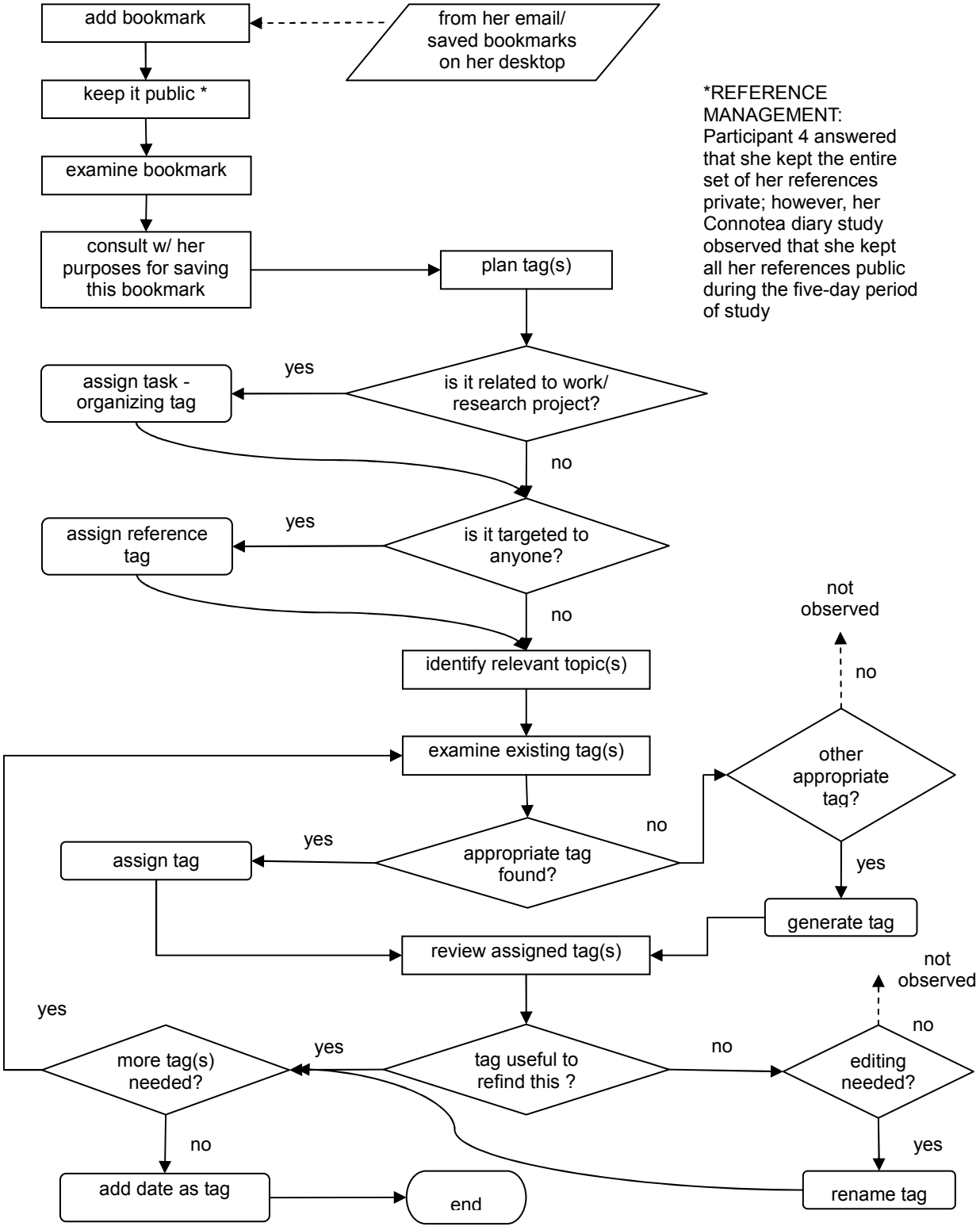


Figure 6.10.1 Participant 5's Tagging Process (Page 1 of 2)

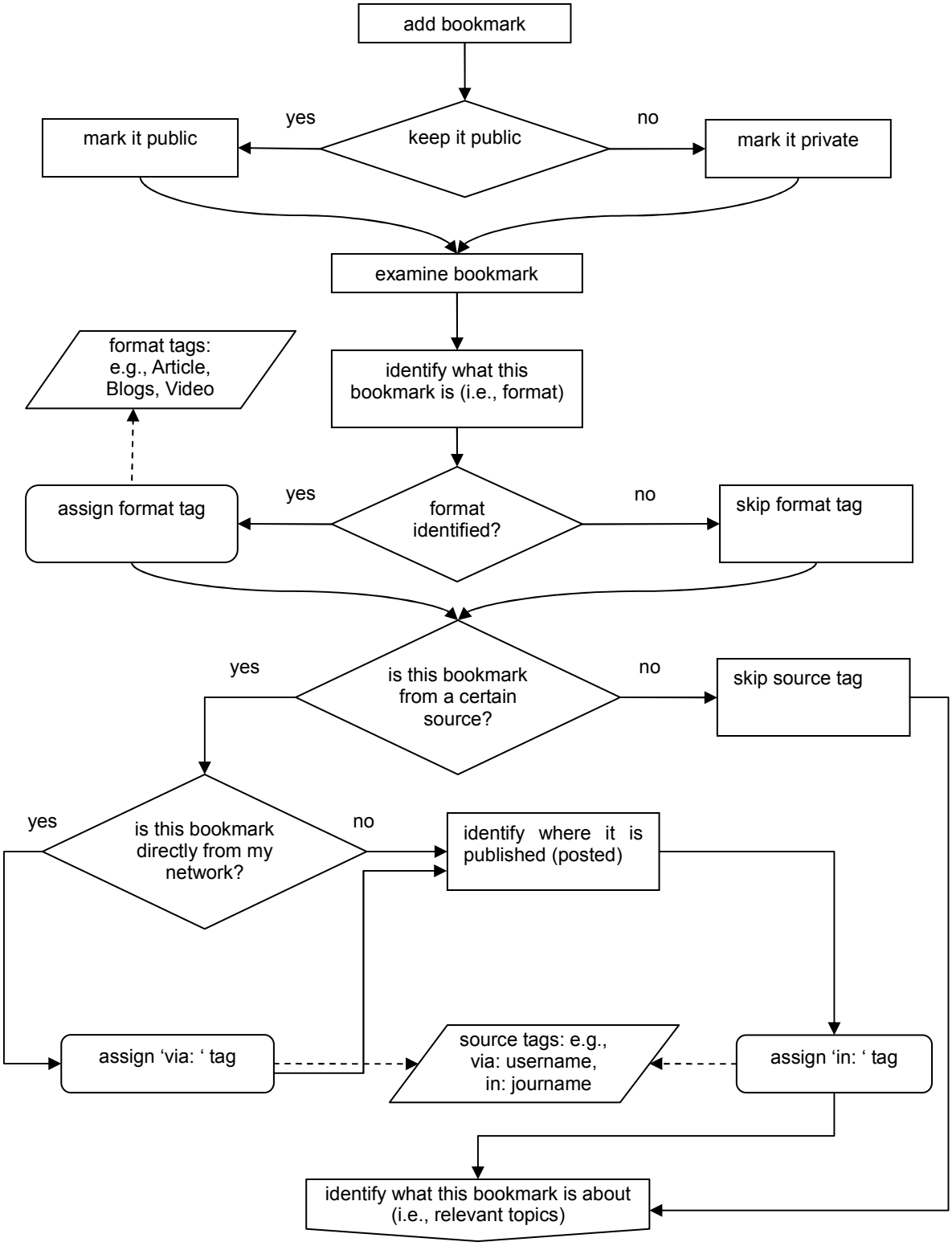


Figure 6.10.2 Participant 5's Tagging Process (Page 2 of 2)

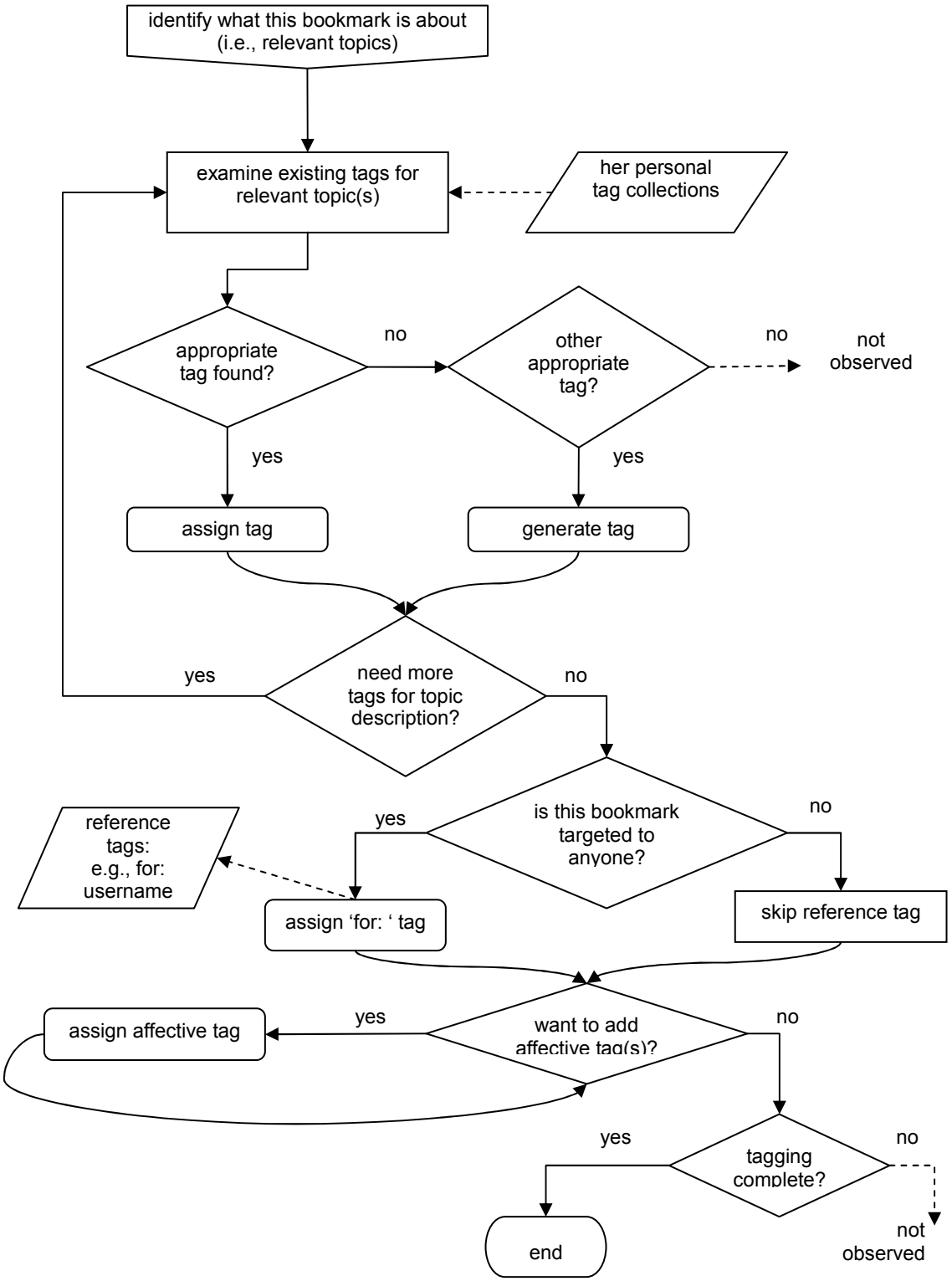


Figure 6.11 Participant 6's Tagging Process

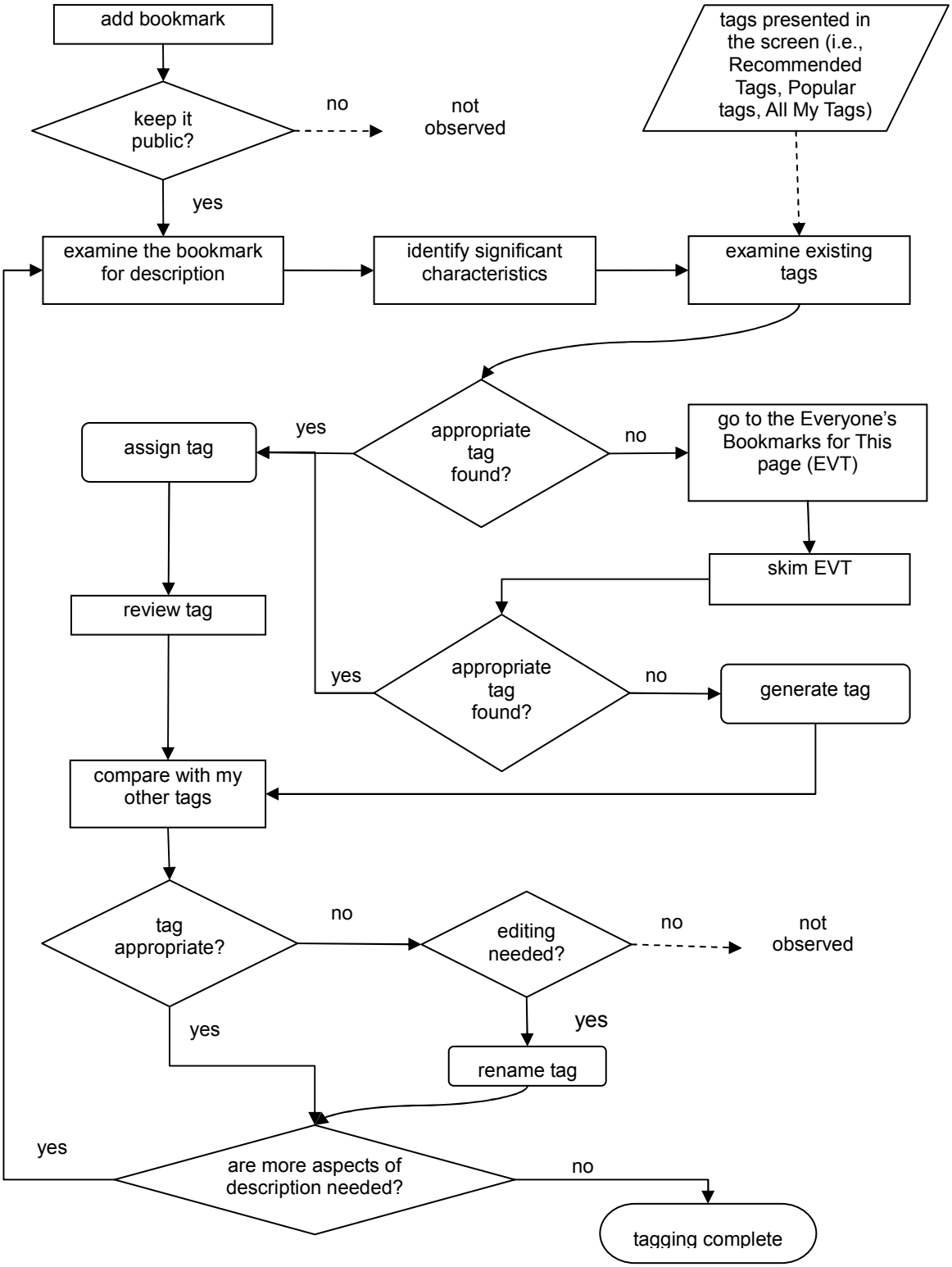


Figure 6.12 Participant 7's Tagging Process: Managing Tag Bundles & Refining Tags

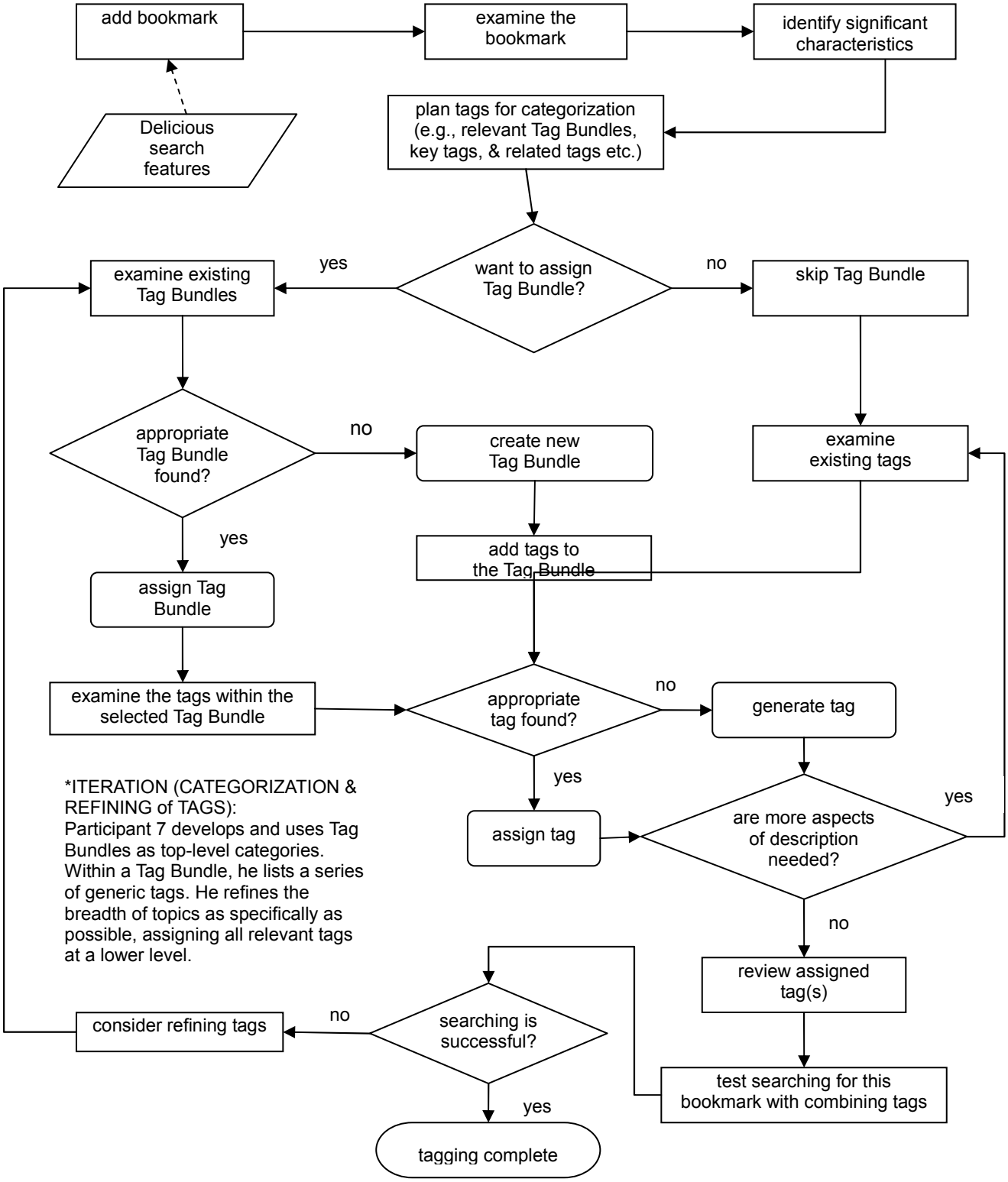


Figure 6.13 Participant 8's Tagging Process: Copying from Others

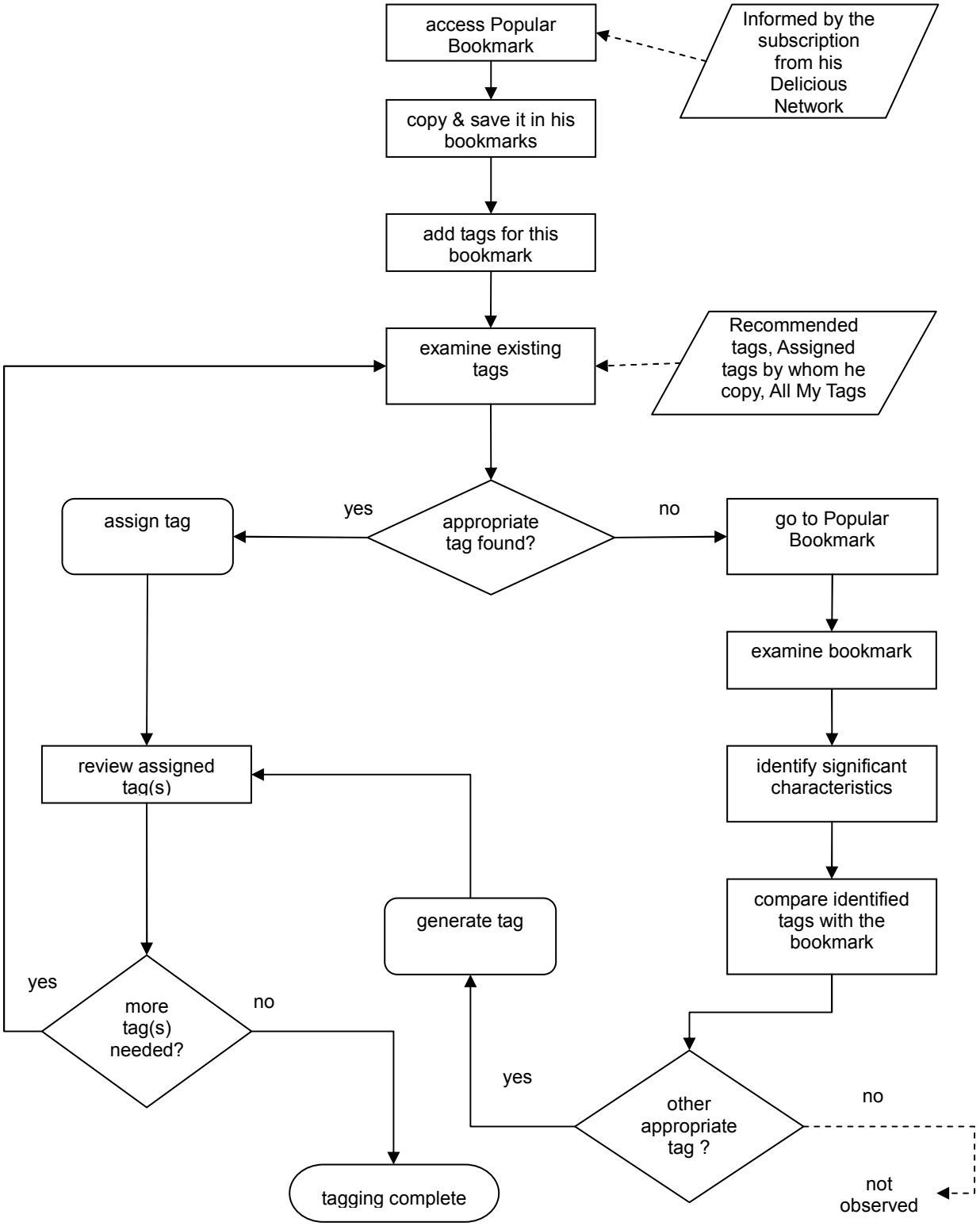


Figure 6.14 Participant 8's Tagging Process: Adding Bookmark

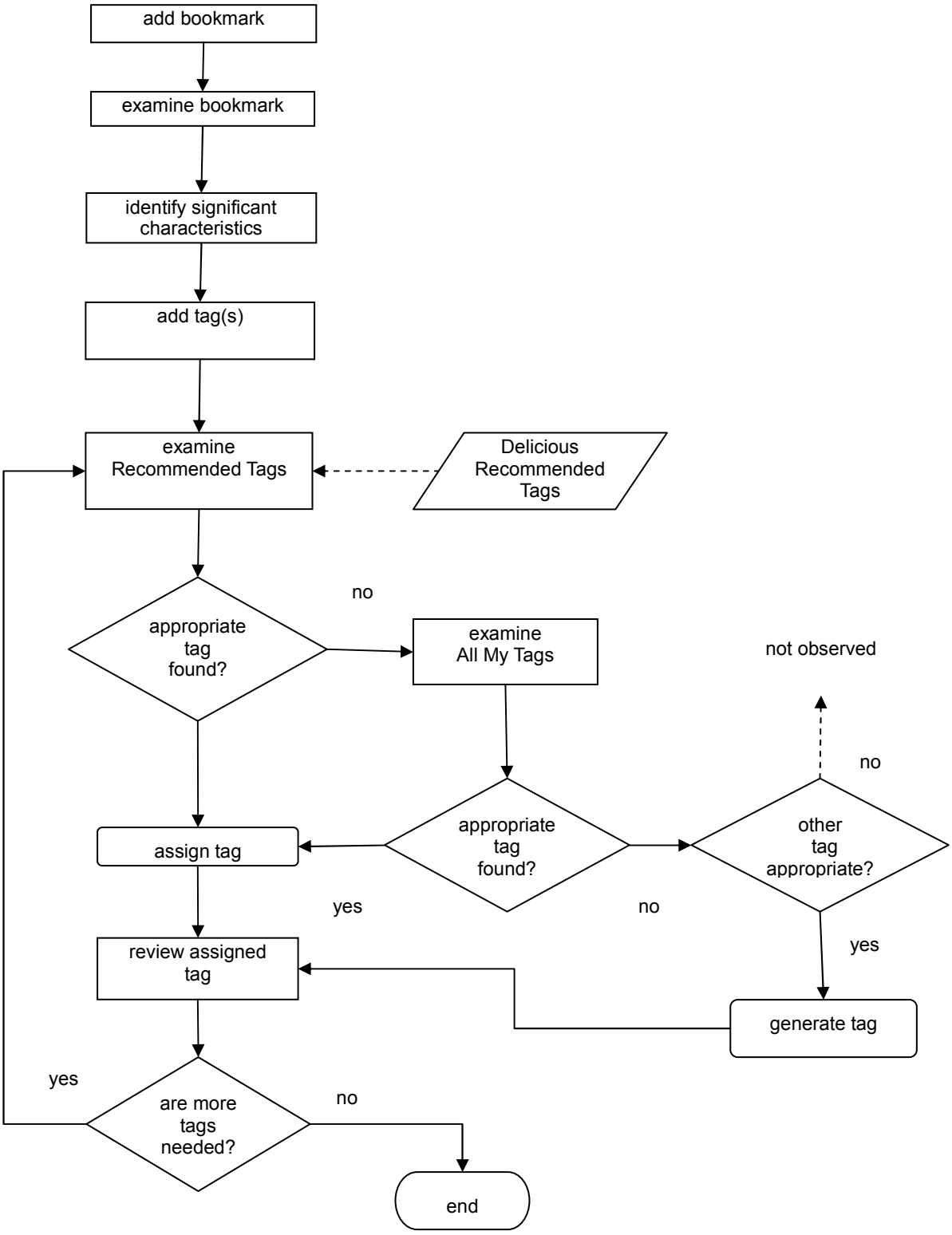


Figure 6.15 Participant 9's Tagging Process

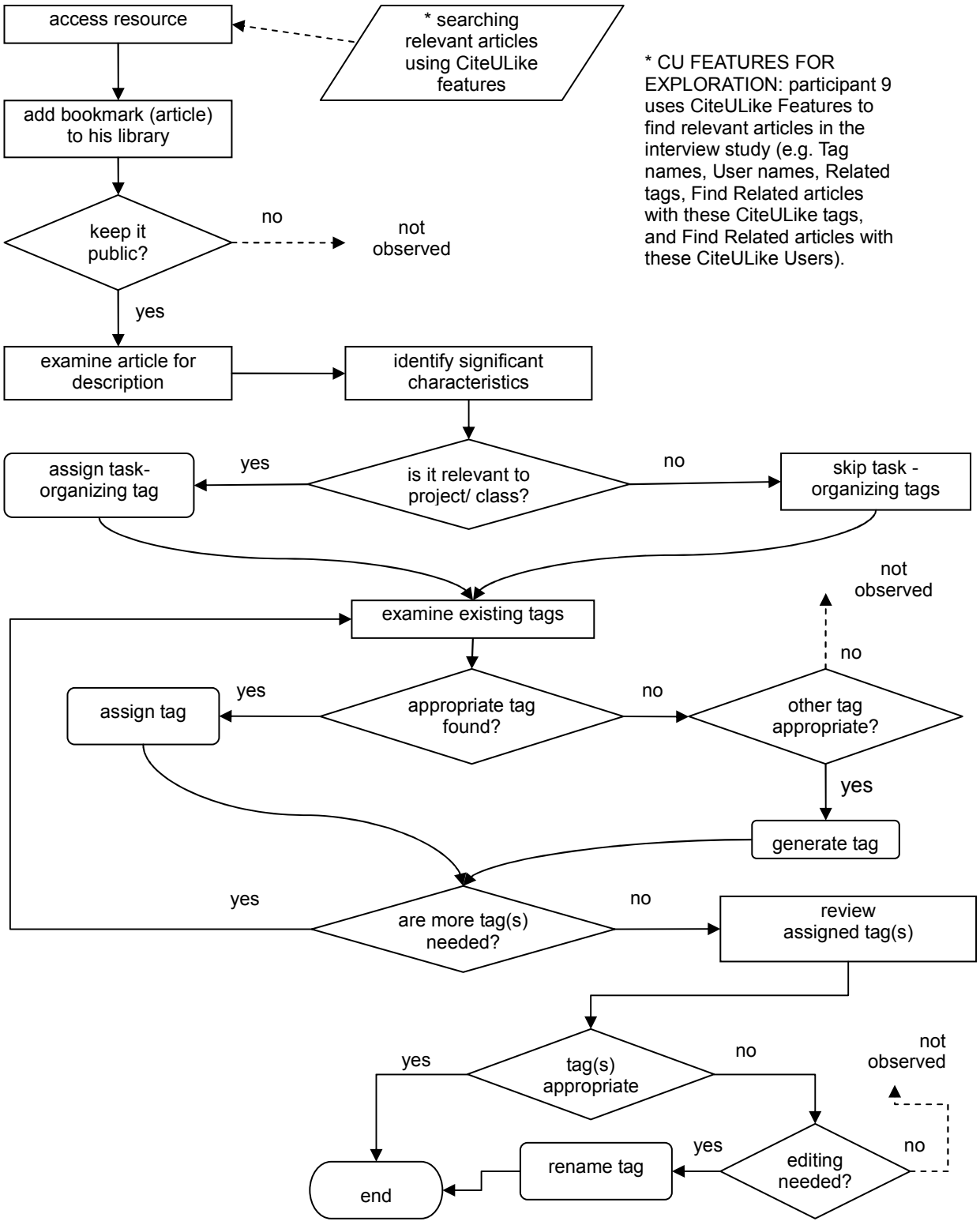


Figure 6.16.1 Participant 10's Tagging Process (Page 1 of 2)

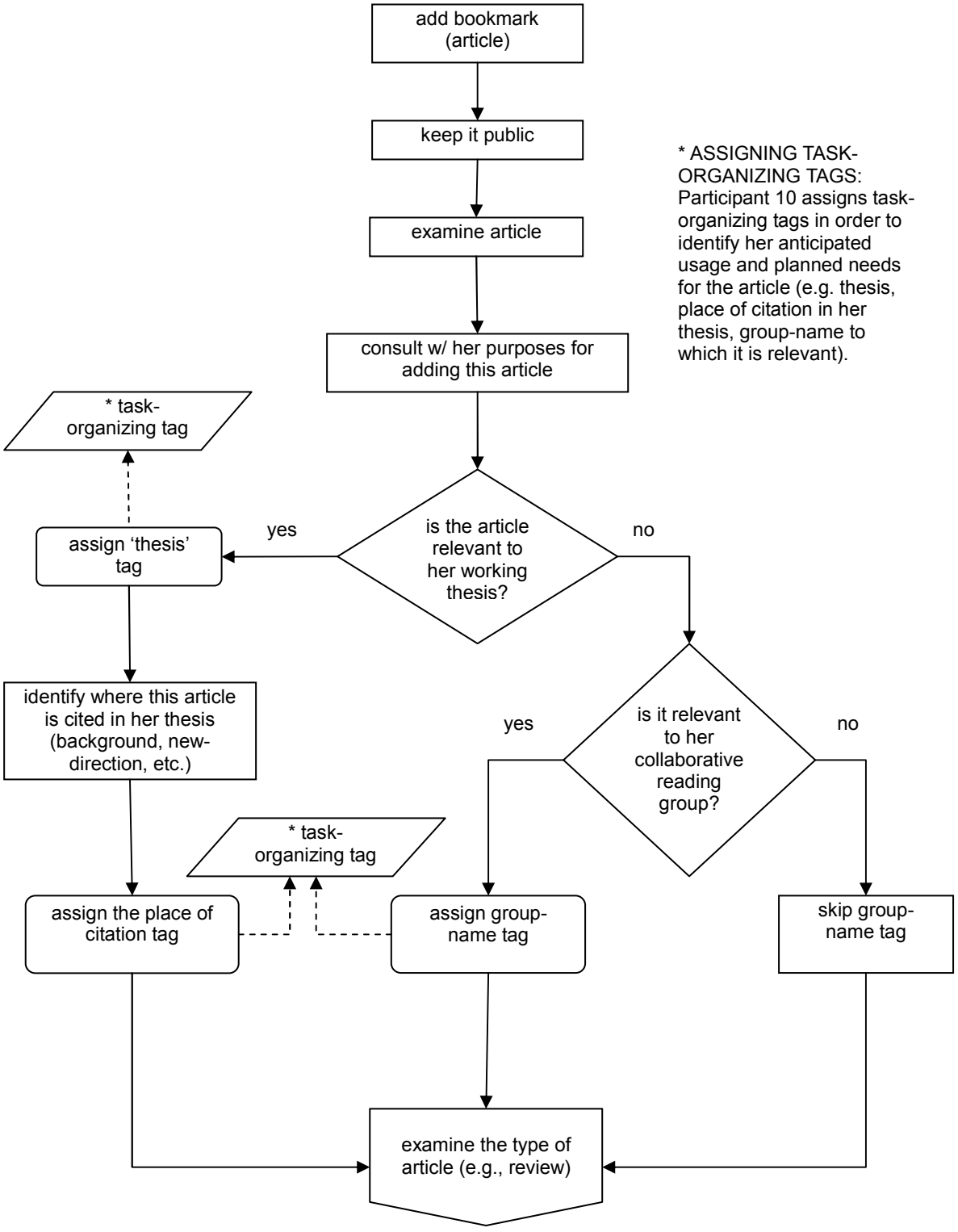


Figure 6.16.2 Participant 10's Tagging Process (Page 2 of 2)

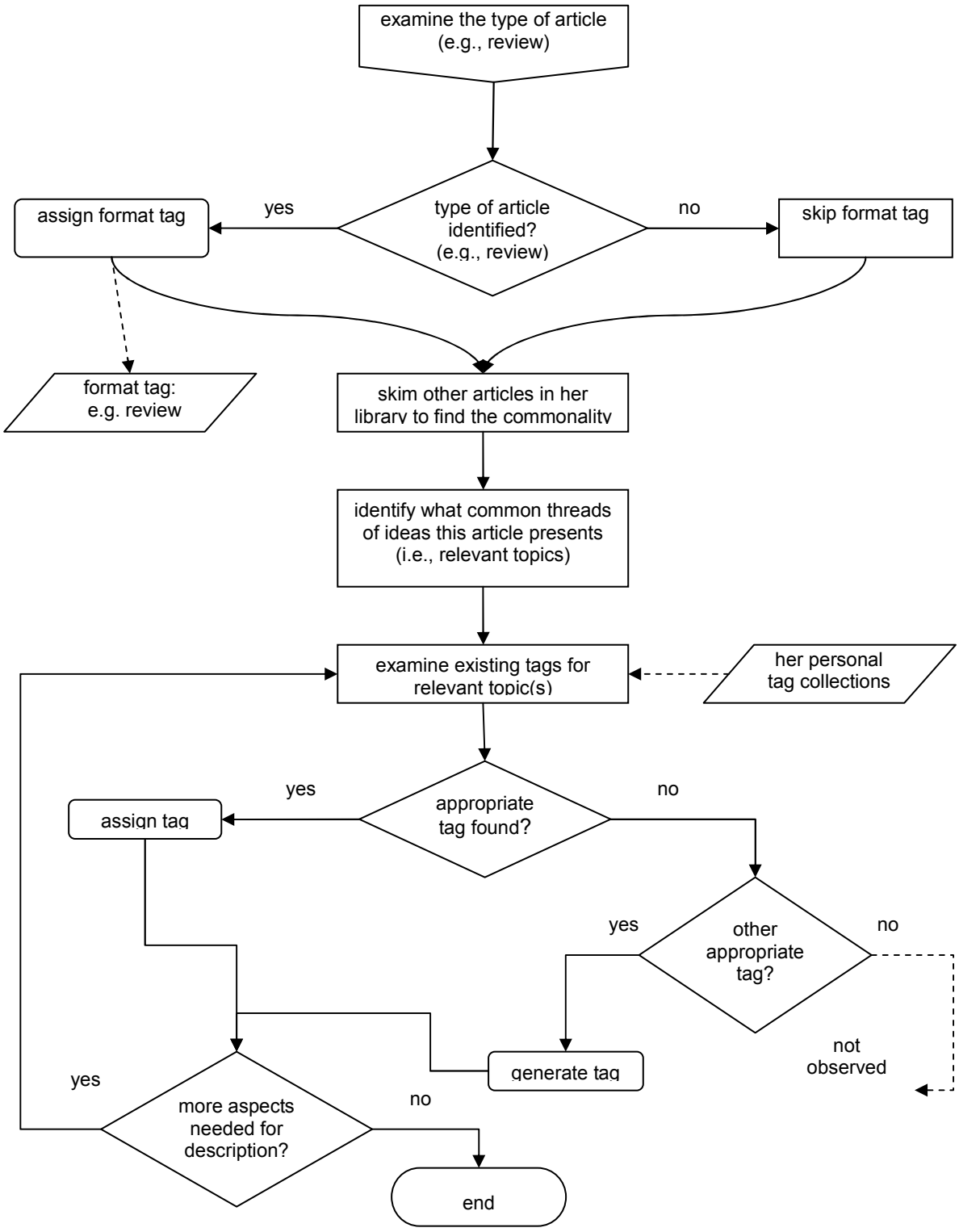


Figure 6.17 Participant 11's Tagging Process

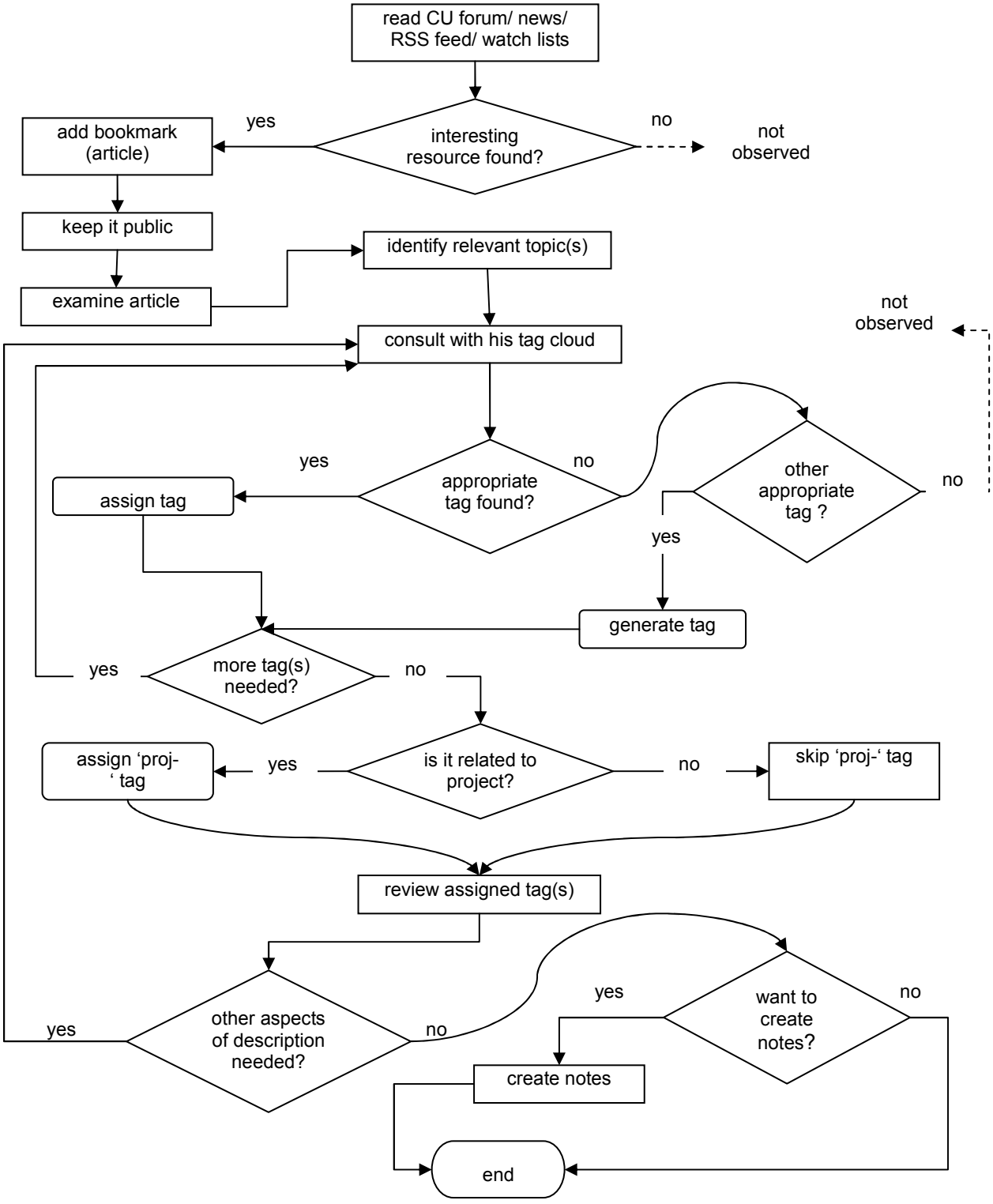


Figure 6.18.1 Participant 12's Tagging Process (Page 1 of 2)

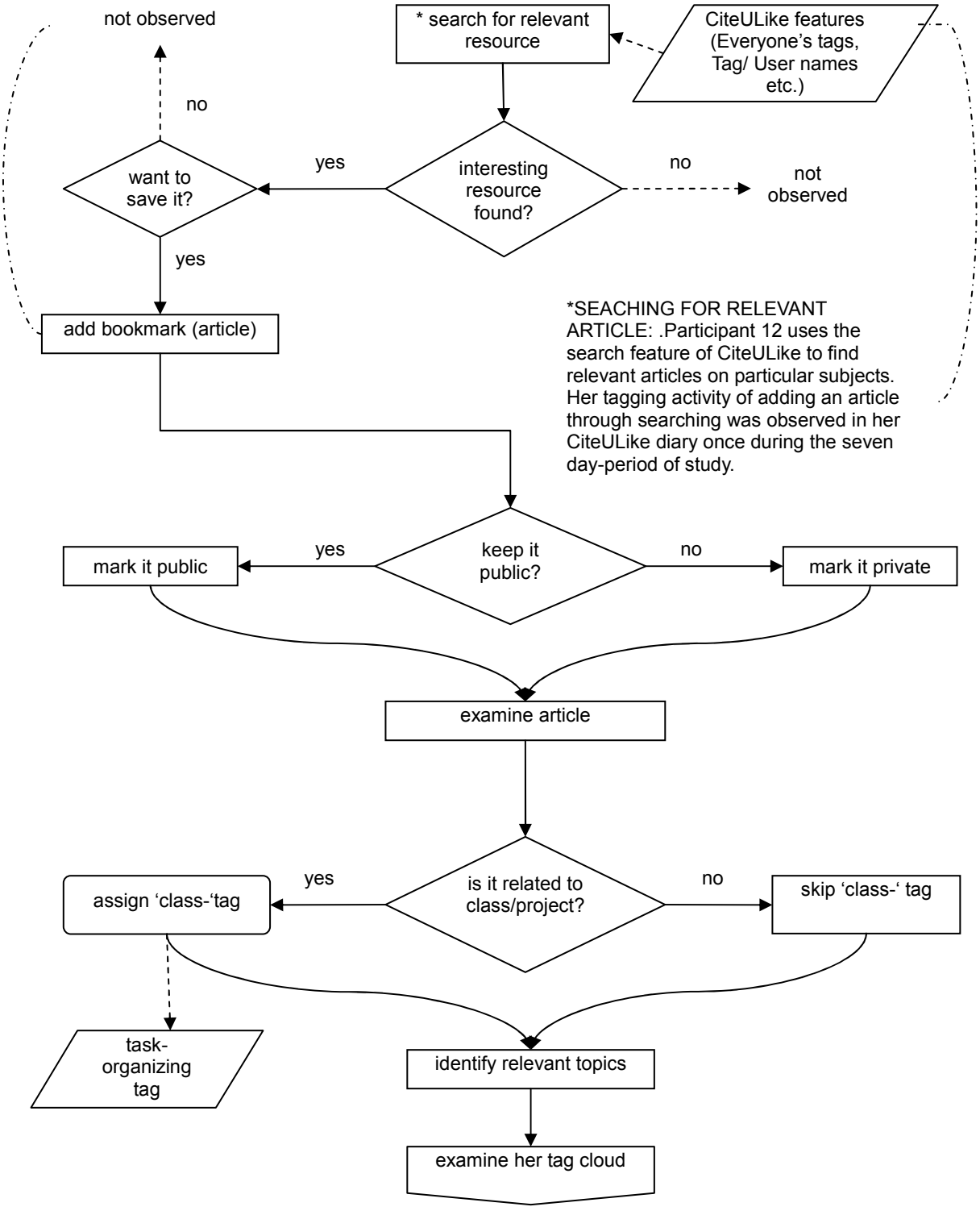
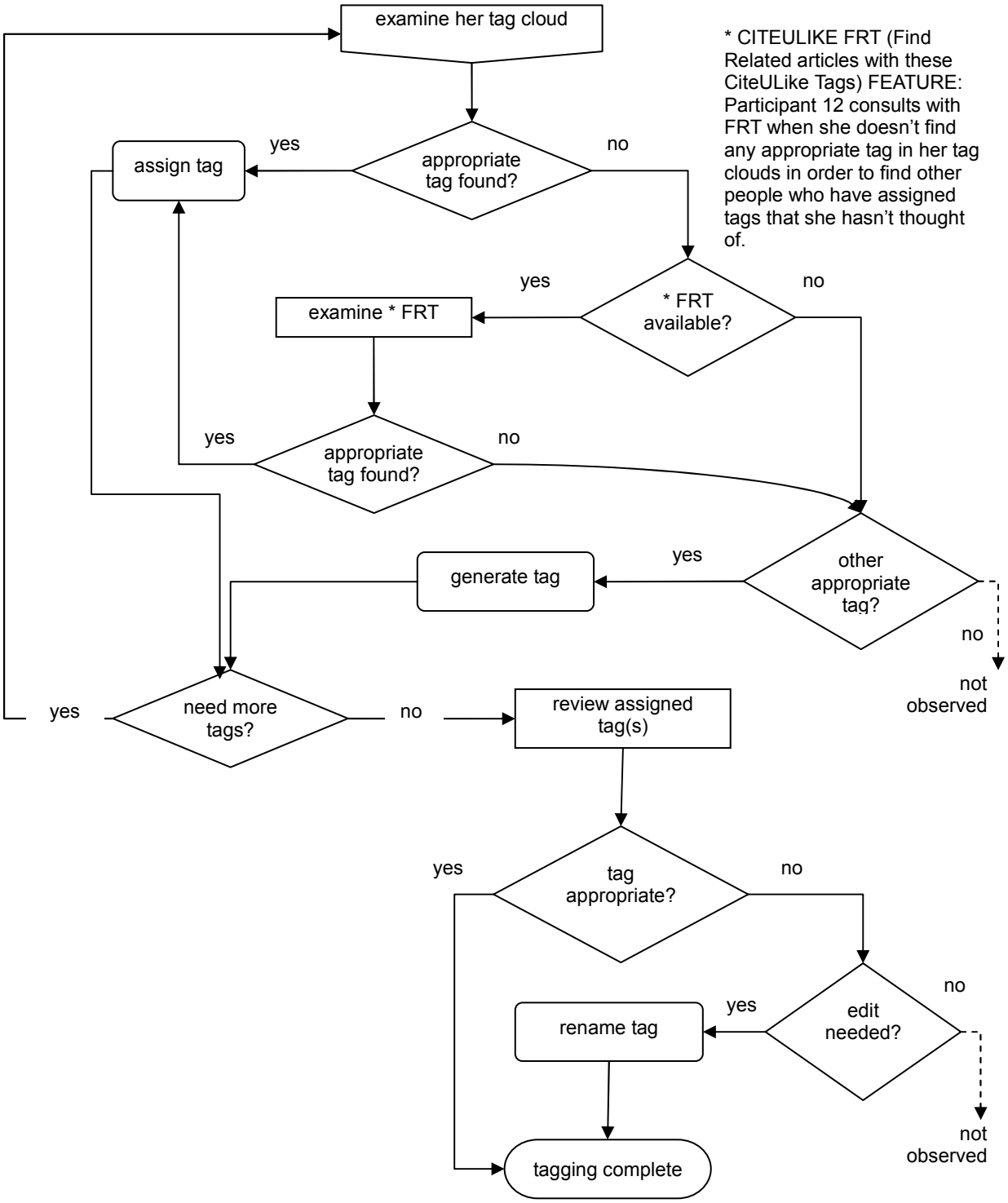


Figure 6.18.2 Participant 12's Tagging Process (Page 2 of 2)



7 FINDINGS AND DISCUSSION: TAGGING ACTIVITES INVOLVED IN THE PROCESS

In order to address the first research question, the tagging activities that folksonomic system users engaged in were analyzed and described in three main concepts, which were derived from the conceptual model: (1) item selection; (2) tag assignment; and (3) tag searching and discovery. These three main concepts were described and specified by relating categories along with supporting quotations from participants. A description and discussion of each category includes participants' comments addressing the way they tag resources using a folksonomy and the problems associated with their tagging activities in tagging processes.

7.1 Item selection

Tagging activities with regard to item selection included:

- access Web resources;
- add a new resource or copy from other's library and save it in their personal library; and
- decide if they will keep the bookmark private or public in the system.

These activities are described in the order in which they appear in the tagging process: this

section begins with accessing a new bookmark (resource) and closes with the privacy setting of the bookmark.

Concepts of "accessing Web resources" and "add/copy bookmark" had already been established as codes in the initial coding schemes derived from the conceptual framework and the results of pilot study. However, the activity regarding the privacy setting of bookmark was not reflected on any of the other codes already established, which was inherent in the tagging process. Whether participants decide to keep the bookmark private to their personal library or public for anyone to see in the system, essentially relates to their tagging motivations and their awareness of the public nature of tagging. A new concept, "privacy setting of bookmark" was therefore established. In addition, the initial concept, "searching a specific tag" was moved to that related to the activity of tag searching or discovery which will be discussed in Section 7.3, Tag Searching/ discovery.

7.1.1 Access Web resources

Further analysis revealed a number of categories relating to the concept, accessing Web resources. The categories involved where and how participants obtain a new resource. A

commonly cited way of accessing resources is through friends or colleagues, who are those outside their social network in the folksonomic system. The following quotations illustrate this category:

> Few days ago I started a phd here […]. My supervisor suggested me to read a review on bioinformatics methods using in population genetics. We will discuss on this article the next week (Participant 2, diary entry #2).
>
> Friend of mine suggested me to read this paper (Participant 2, diary entry #13).
>
> Author is a colleague of mine. We work in the same group. Reading this paper will help me a lot to understand how people work in this group (Participant 2, diary entry #15).
>
> Someone sent me an e-mail containing this DOI suggesting that I would like to read the paper (Participant 9, diary entry #1).

Participants may import resources from the existing references to their personal library in the folksonomic system. Occasionally, they imported resources from a system which they used to store their personal references, such as their email or desktop. Examples of accessing resources in this way include the following:

> I started to load in a few references that I pulled up for a student who was working for the university and needed information to complete a research project about Student Retention or Enrollment. I had emailed the reference to her and cc'ed them to myself so I could load them up into my office computer where Connotea is loaded. So from the email to myself I loaded the references (Participant 4).

Another participant reported that he was developing a new library in Delicious, importing

his existing references from his previous library. He described the reason for importing resources to his library: he wanted to reduce the number of bookmarks and alter the way he tagged. He stated:

> […] I have also tried recently just using one tag per bookmark but this would ruin my ability to display and find bookmarks on my website (one of the reasons I use delicious). So I deleted my account and started again. I also started again because I had too many bookmarks, most of which I never used. Delicious provides no way of removing or editing en masse, or for seeing how often bookmarks are used (although as a web designer I know such a thing is possible to store and keep track of. I'm sure they have this info stored in their database, even if they don't admit it publicly). In internet explorer I had around 700 bookmarks when I started using delicious, accrued over several years. 6 months after using delicious I had nearly doubled this. I had too many and couldn't find what I had bookmarked, I wasn't using all these bookmarks and probably never would. So I deleted my account and started again. I now have under 200 and restrict how often I bookmark and what I bookmark. I now have decided to search more with search engines [rather] than fill up delicious with bookmarks I don't need, and can't find again even using delicious' search engine (Participant 7).

Several comments made by participants illustrate accessing Web resources through the features which the folksonomic system provided. A number of participants reported that they collected the latest references from users whose work they were interested in, through the folksonomic system features:

> I was browsing the article posed by another user, with which I have a tagged article in common (Participant 2, diary entry #14).

> Browsing bookmarks from a guy that had already bookmarked this article (Participant 2, diary entry #16).

> I found this article through Everyone's tags. I think it very interesting and useful to my research (Participant 12, diary entry #3).

> I loved search features of CiteULike. They make me fun finding unexpected but relevant articles to the subject (Participant 12).

Participant 11, for example, obtained newly posted articles on CiteULike through several CiteULike features. He was actively engaged in additional networking services which CiteULike provided, including 'CiteULike Forum' feed, 'News' feed and 'Neighbor'. He described his daily routines of tagging in CiteULike, relating to his way of accessing new resources:

> [I am] reading the CiteULike Forum Feed and the CiteULike News feed to find new features/ new issues. This occasionally leads to me trying out new features on my references, etc. [I] read feeds, including CiteULike watchlist, some neighbors. Sometimes their entire library, sometimes only certain tags (Participant 11).

Another participant also described how he accessed new resources through the Delicious features, 'Popular Bookmarks' and 'Network' subscription:

> [Through Popular Bookmarks and Network] I can spend some time surfing in top links…sometimes I can find someone with very similar interest; I currently follow 2-3 users (Participant 8).

7.1.2 Add bookmark or copy from other's library and save it in their personal library

How participants access Web resources determines the way they add new bookmarks, that is resources selected to save in their personal library, as well. For example, if participants access a given resource through browsing in the system, they usually copy the bookmark and save it in their personal library. The successive processes, that is browsing or searching a certain tag in the folksonomic system, and then copying and adding the found resource to their personal library, were commonly identified (see Figures 6.6, 6.13, and 6.18.1).

On the other hand, it is difficult to separate two activities, accessing a resource and adding a bookmark, if the participant did not specify how he obtained the resource. Because participants were asked to record the tagging activities involved with each resource they tag in their diary, most observations of their tagging activities began with adding a new bookmark. According to data analysis of their diary studies, participants access a resource which they want to save in their library, and then they add it immediately in their personal library. Thus, the distinction between two activities, accessing a resource and adding a bookmark became somewhat blurred.

7.1.3 Decide if they will keep the bookmark private or public in the system

Every time participants add a new bookmark in their personal library, the folksonomic system asks them if they want to keep the tagged bookmark private only to their library or publicly visible to anyone. In terms of privacy settings, five participants made some of their bookmarks public and others private; and seven participants made their entire set of bookmarks public for anyone to see. As mentioned previously, such a decision is closely related to their tagging motivations as well as their awareness of the publicness of tagging, which will be discussed in later chapters.

The participants, who maintained different privacy settings depending on the bookmark, acknowledged that they would tag each resource differently for different purposes. Indeed, they distinguished between bookmarks private to themselves and ones to share with others very clearly:

> I keep almost all my bookmarks public except for those that are only useful to me, such as my school's email website and related websites (Participant 6).

> I don't want to make all my stuff public. I think something like articles I'm considering to use in my class are very personal things. So, I usually check "only private to me" when I bookmark articles for my personal purposes (Participant 12).

Conversely, a relatively large number of participants would be aware that they could help others who share similar interests to find if they kept their bookmarks public. Comments that illustrate this finding were:

> I don't collect resource[s] randomly. I think people with common sense may put the name or theme in a similar way […] People tag information based on their interest so they may tag similar resources. I could find some good resources from others' collections after I accessed others' connotea collection […] I would [tag] more specific, in consideration of the potential of sharing with others. I wanted to reorganize all related items under the tag […] so that others could also find it more easily (Participant 3).

However, some participants did not link their motivations for tagging to the privacy settings of the bookmark. They identified certain attitudes which suggested that their motivations for tagging would target resources only to themselves even though they kept their entire bookmarks public for anyone to see (Participants 4 and 7). These participants reported that they did not consider any social interaction on a folksonomic system.

Others relate their decision about the privacy settings of their bookmarks to their awareness of the publicness of tagging. One participant described his thoughts on the issues related to privacy settings, illustrating how he decided on these privacy settings depending on the types of resources:

> […] "public vs. private" is different depending on posts vs. notes vs. PDFS. I never post any private references. I do create private notes that remind myself

> why I posted the reference. I almost always post all references to the private group I belong to (colleagues at my institute) (Participant 11).

He went on to say:

> I always select "I have the right to distribute this document". This prevents me from ever sharing any of posted references with public groups. I belong to one private group (my colleagues at my own institute) and one public group. I would like to share references with both. But, I am not allowed (legally) to share copyrighted PDFs with the public group. When I upload a PDF, there is no way to share it with one group but not with another group. This should simply be another series of check boxes. Right next to check boxes for "Post to:" should also be "Share PDF with these groups" with another series of check boxes (Participant 11).

7.2 Tag assignment

Tagging activities regarding to tag assignment included:

- examine the bookmark (that is, the saved Web resource) for tagging;
- add tags:
    - generate new tags; or
    - copy tags from the existing ones;
- review assigned tags; and
- edit tags:
    - rename tags; or

- delete tags

These activities are described in the order in which they appear in the tagging process (see Section 6.3 Tagging process flowcharts of 12 participants). This section begins with examining the bookmark for tagging and closes with editing tags.

As data analysis proceeded, the initial concepts and categories relating to the activities of tag assignment were refined. The initial concepts of "generate tags" and "copy tags from the existing ones" were merged into one concept, "add tags"; and "delete tags" and "rename tags" were also merged into another concept, "edit tags". Additionally, two new concepts of "examine the bookmark for tagging" and "review assigned tags" were added to the initial coding schemes. These two concepts were observed in the previous step of the first two activities respectively: "examine the bookmark" before "add tags", and review assigned tags before "determine editing of tags".

7.2.1 Examine the bookmark for tagging

As mentioned previously, a new concept 'examination of the bookmark' was identified as a step previous to adding tags during tag assignment, in which the participant analyzed

the bookmark in order to determine its representation. Further analysis revealed two categories related to participants' preliminary bookmark examination: identification of significant characteristics of the bookmark and tag planning.

What participants perceive to be significant to represent in the bookmark is expressed in terms of tags; therefore, what participants understand about the bookmark is of utmost importance for tag assignment. A variety of ways in which participants identify significant characteristics of the bookmark for tagging were identified. Participants' comments relating to how they identified significant characteristics for tagging include the following:

> I think of what criteria I would think of when searching for this item again. Would I think of [it] as funny, or related to a certain cite or related to a certain theme or geographic region? (Participant 6)

> [I examined the bookmarks] according to the relevance to my many projects; their place of citation (or the selection they are going to be cited in) my final document; common threads of ideas they represent; big ideas they represent; commonality with other articles in my library; groups in which they are shared; subject to which they belong; [and] their relevance to my studies (Participant 10).

> [I] ask myself if this article is primarily "addressing" that subject […,] if a paper is relevant to the project [that I am currently working on …and it is] from certain research institute/ research groups (Participant 11).

As seen in flowcharts of tagging processes, these participants' approaches to identifying significant characteristic of the bookmark determine their overall tagging pattern, followed

by subsequent tagging activities. In particular, participants' analysis of a bookmark for representation was closely related to their decisions about what types of tag they would use. For example, their analysis of the contents of a bookmark resulted in their using topic tags as well as affective tags (see Figures 6.10.2 and 6.16.2). Their analysis of what the bookmark is resulted in using format tags (see Figures 6.10.1 and 6.16.2). Analysis of whether the bookmark is from a certain source or where it is published produced source tags (see Figure 6.10.1). Analysis of whether the bookmark is related to work or a project, and whether it is targeted to an individual or group, produced task-organizing tags and reference tags respectively (see Figures 6.9, 6.10.2, 6.15, 6.16.1, and 6.18.1).

In addition, participants considered their tagging plan, that is, how to organize their tags and bookmarks, while they examined the bookmark (Participants 2, 3, 4, 5, 7, 8, 9, and 11). Their tagging plans were most often associated with establishing a cohesive classification with their tag collections. They talked, for example, of "defined" (Participant 2), "proposed" (Participant 8), or "prefixed" (Participant 11) tags they would use. In other words, participants planned to use a set of defined tags which reserved a specific word to represent a specific concept in advance of tagging. In their tagging diary they also observed that they defined a set of tags in their description of tags such as: "I am going to collect all

articles [resources] that make use of this topic under this tag". As a result, these participants used a relatively limited number of tags and organized them systematically.

Of these participants, two (Participants 2 and 3) did however make additional notes on the definitions of tags in the folksonomic system, while others skipped this process. Both these participants used Connotea, adding notes to certain tags in order to clarify their use of those tags (See Figures 6.7 and 6.8). They were very aware of how to create a 'Tag Note' placed at the top of the list of all the bookmarks they have posted with a particular tag. They probably learned with experience that they could explain to other users (visitors) or remind themselves about the collection and the particular tags using 'Tag Note' in Connotea.

In many cases, participants' tag plans were related to establishing a hierarchical structure of the subject matter. A number of participants attempted to organize their tag collections hierarchically in order to represent the breadth of subject matter of their bookmarks (Participants 1, 2, 4, 6, and 7). The following quotation is an example of those who linked their preliminary examination of bookmarks to the way in which they classified bookmarks and tags. This participant, in particular, developed tag bundles in order to represent generic top-level categories, and listed a series of generic tags and specific tags at a lower level in Delicious. In the interview session, he spoke of his tag plans:

> I use bundles [of Delicious] as folders and then have key tags that act sort of like subfolders [in order to represent the subject matters of the bookmark…for example] I have also tried […] giving a bookmark the following: javascript, javascript_events, javascrpit_events_mouse and so on […] (Participant 7).

Other participants also noted that they organized their tags by the breadth of subjects prior to tagging, such as general topics as well as specific topics (Participants 1, 2, 4, and 7). The followings were the examples of tags which these participants provided:

> Dewey Decimal Classification: *subject*
> LibraryThing: author/subject
> Social cataloging application: subject
> Social Semantic Web: *subject/general* (Participant 1, diary entry #6, emphasis added).

> *Subject*: "Health"
> *Sub-subjects*: "Human Body ", "Smoking", or "Prescription Drugs" (a different sub[-subject] distinguishing from "Smoking") (Participant 4, emphasis added).

As well as the breadth of subjects, participants reported that they considered their purposes for saving the bookmark first when they examined the bookmark for tagging (Participants 4 and 5). For those participants, anticipating usage of the bookmark is a critical element when they examine the bookmark and determine tags for it. One participant described her thoughts on her plan for tagging:

> […] – I have a catalogue of websites in Favorites and in Bookmarks [in my desktop] – the only difference between them and Connotea might be that I can't search for items easily in these two other systems. What I would like to be able to do in Connotea is to organize information by project (basically by folder),

> e.g., LIBR 510 Information Organization Website Design Project[11] – I guess I could do that if all the websites and citations were tagged with "LIBR 510 Information Organization Website Design Project" (*follow-up email on September 26, 2008 with Participant 4*).

In fact, this participant was observed to tag her bookmarks according to her plan, identifying that the bookmark was related to her work or research project, or targeted to anyone with whom she wanted to share in her work place (see 6.5).

Another participant linked her examination of bookmarks for tagging to her anticipated search for that bookmark. In the interview session, she spoke of her tag plans which helped her with reusing the bookmarks: "it [is]really easy to find stuff again no matter which way I remember it-topic, format, or source" (Participant 5). About her tagging strategies, she went on saying: "for example, if it's from a certain source, I'll always tag it with an in:XXX tag. [I]f it's a journal or magazine article, I always use article as a tag". Her Delicious diary study demonstrated that she maintained these rules with sufficient consistency to allow aggregation of her bookmarks in a useful way. As is evident in these quotations, the participants who preferred to plan their tags in advance of tagging were very concerned about the consistency of tags. They paid attention to establishing a set of strategies with

[11] 'LIBR 510 Information Organization Website Design Project' is used as a substitute to reserve the confidentiality associated with the tag participant 4 assigned.

consistent format and methods of tagging. The following quotations are from participants who spoke of their concerns and experiences with the consistency of tags:

> Sometimes I mess with tags: e.g., I confuse between capital and normal letters, or with spaces, or with terms used, etc (Participant 2).

> [when tagging] typing in letters […] is very uncomfortable. Frequently the letters were not clear so I needed to type them several times (Participant 3).

> […]deciding whether to use plural or singular forms of words is difficult, but I always make sure that I stick to one form[.] I never use both. Deciding between german and germany is difficult [;] sometimes, I need both but I don't want two tags, so anything that is german or in the german language uses germany, even if german would be better (Participant 7).

Overall, participants' preliminary bookmark examination was a very complicated process and a critical stage in their tagging processes. Participants' subsequent tagging activities, such as what types of tags and what features of folksonomic systems they would use, were usually decided upon at this stage. In particular, participants' examination of bookmarks was closely related to their tag decisions. Therefore, participants' perceptions and decisions about what types of tags to use were developed from this stage and will be discussed more in a later chapter (see Section 8.2, Types of Tags: function of tags, users perceive, to perform).

7.2.2 Add tags: Generate or copy tags

The preliminary bookmark examination results in formation of sets of tentative tags in participants' minds. This preparation enables participants to generate alternative tags or evaluate related ones in order to copy them to their personal library. The concept of adding tags refers to the translation of what participants understand about the bookmark into terms, or tags during the tagging process. In terms of adding tags, two categories or patterns of behavior emerged from the analysis: participants copy a tag from the existing tags (copy a tag) or create a new tag (generate a tag).

(1) Copy tags from existing ones

A commonly cited way of adding tags was copying tags from existing ones, that is, tags previously used for the current bookmark. When participants are prompted to add tags for the current bookmark, they usually consult the existing tags and select one to copy into their library. Further analysis revealed a number of sources for tags related to this category, copying from existing tags: where the participants evaluated and copied tags for the current bookmark and what features of folksonomic systems they used in copying tags. These were broadly classified as follows: tags previously used by the participants themselves (personal

tag collection), tags suggested by the folksonomic system (system-suggested tags), and tags generated from other source of related tags and extensions.

a. Personal tag collection

Participants cited their personal tag collection as an important source used to search for appropriate tags for the current bookmark. A number of participants observed that they consulted with their personal tag collections in adding tags to the current bookmark (Participants 2, 3, 5, 8, 9, 10, 11, and 12). The following quotations illustrate how participants consulted with their personal tag collections or tag clouds in order to add tags:

> [When I have an item to tag, the process that I usually follow is] 1. think about the most important keyword; 2. think about other related keywords; 3. use tags that I used before; 4. see suggested words (Participant 3).

> [I] think some tags [and] look at the proposed in my cloud (Participant 8).

> I think about each tag in my tag cloud and ask myself if this article is primarily "addressing" that subject (Participant 11, emphasis in original).

In particular, of the participants who preferred to use their personal tag collections in adding tags, four indicated that they consulted with their tag collections first to assign tags to the current bookmark (see Figures 6.7, 6.8, 6.13, 6.17, 6.18.1, and 6.18.2). In such cases, if unsuccessful in the search and having exhausted all the possible tags in their tag

collections, they proceeded to search for complementary tags that could be used for the bookmark. The following quotation is from a participant who started by examining her tag collection first when assigning tags:

> I look up my tag cloud and choose the appropriate ones. If I can't find the appropriate one, then I add a new tag that is needed (Participant 12).

These participants might decide to finish the examination of tags from their personal tag collections at any point, and proceed to search for alternative tags from other sources in the folksonomic system. What sources other than personal tag collections they use depends on their familiarity with the features folksonomic systems provide.

In terms of personal tag collections, several features of the folksonomic system enabled participants to view their previously used tags quickly as well as select one easily. On Delicious, participants' personal tag collections were displayed promptly in the screen when they added tags for the current bookmark. The feature named 'All my tags' was displayed along with the features, 'Recommended' and 'Popular' below the tag box (see Figure 7.1). Similarly, CiteULike presented the participant's personal tag cloud promptly in the top right corner of the screen when they wanted to add new tags to the current bookmark (see Figure 7.2).

Figure 7.1 Delicious' Display of a Personal Tag Collection in Adding Tags

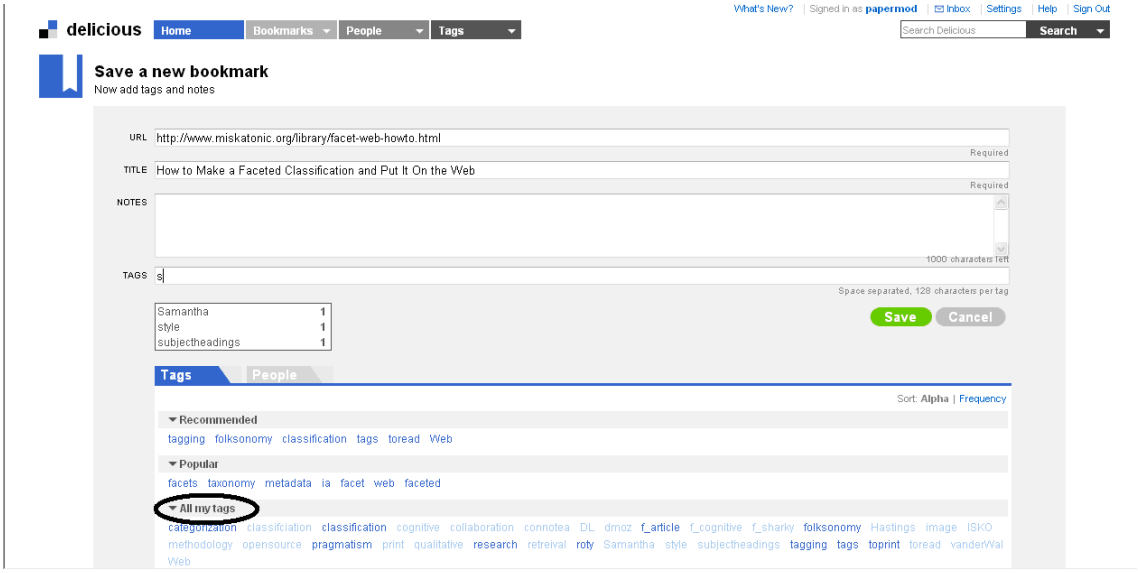
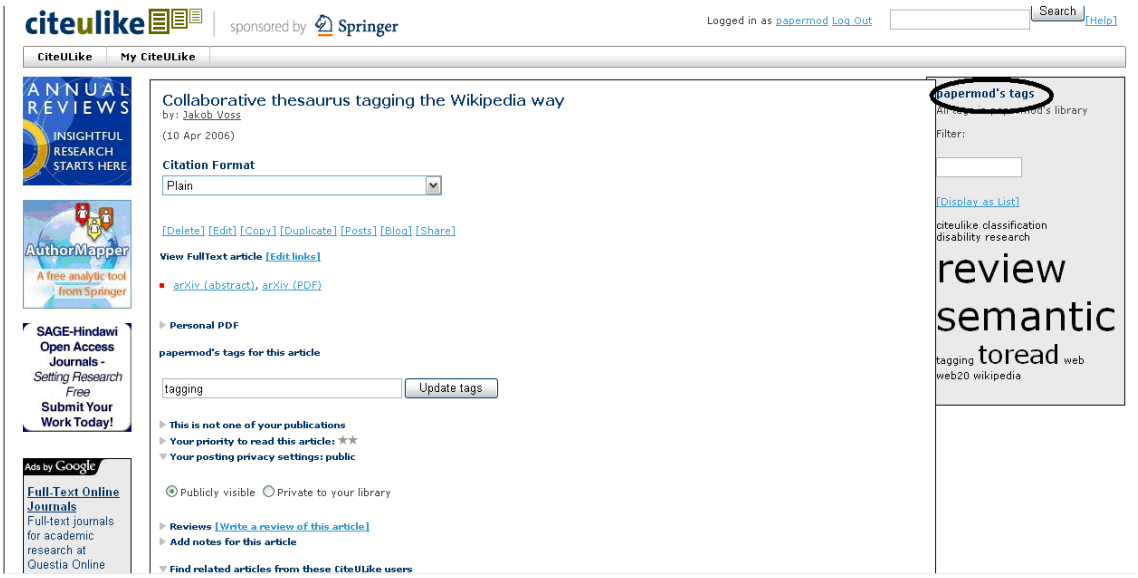


Figure 7.2 CiteULike's Display of a Personal Tag Collection in Adding tags

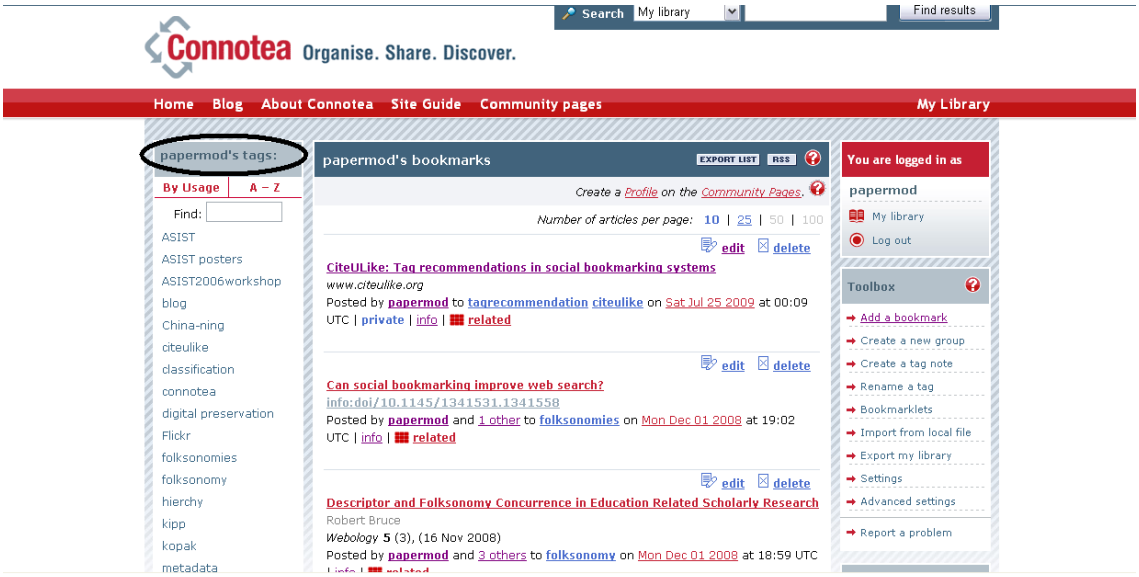


Such features for presenting their personal tag collections might influence participants' tag decisions. Indeed, qualitative diary studies indicated that the participants of two folksonomic systems (Delicious and CiteULike) routinely used these features in copying

tags to the current bookmark (see Figures 6.11, 6.12, 6.13, 6.14, 6.16.2, and 6.17).

On the other hand, Connotea does not present additional features for participants showing their personal tag collections at the stage when they are asked to add new tags to the current bookmark. Instead, Connotea provides participants with their tag collections on the left side of a list of bookmarks they have saved on the page of their personal library (Figure 7.3).

Figure 7.3 Connotea's Display of a Personal Tag Collection in the Personal Library



b. System-suggested tags: using tag suggestion features (CN, DL, CU), and 'Recommended Tags' and 'Popular Tags' (DL)

Once participants are asked to add the tags they wanted in the tag box, the folksonomic system presents a list of suggested tags for the current bookmark with the prompt screen.

These system-suggested tags are generated from the existing tags used by the same user, assigned to the current bookmark by other users, or generated from other related users. In terms of system-suggested tags, two different features of the folksonomic system were identified: 'Tag Suggestions' features of Connotea, CiteULike, and Delicious; and the features of 'Recommended' and 'Popular' tags of Delicious.

All three folksonomic systems present 'Tag suggestions' which provide a tag auto-complete feature in the tag box. Once participants enter any word in the tag box, Connotea and CiteULike provide 'Tag suggestions' immediately. Delicious also shows a list of previously used tags for the current bookmark automatically. These 'Tag suggestions' are usually tags generated from participants' own tag collections as well as tags assigned to the current bookmark by other related users.

As well as these 'Tag suggestion' features, Delicious displays a list of suggested tags for the current bookmark: 'Recommended', 'Popular', 'All my tags'; and if the participant developed tag bundles, 'Tag Bundle'. The first two features provide the participant with relevant tags which Delicious suggests be used for the current bookmark, based on existing tags assigned to the same bookmark by other users or generated from other sources of related users. The latter two features are linked to tags previously used by the participant,

which were discussed previously in Section, a. Personal Tag Collections.

These Delicious features providing system-suggested tags, guiding participants to add a tag easily by simply clicking on it, were considered important by them. Indeed, Delicious Diary studies showed that one Delicious participant most often used 'Recommend Tags' when assigning tags (Participant 8). His Delicious Diary study demonstrated that during the seven-day period of study, 47 tags were recommended by Delicious of a total of 50 tags which he assigned.

Analysis revealed that of the 12 participants, four used these system-suggested tags when assigning tags (Participants 2, 3, 8, and 12). They considered these tag suggestion features an important source, specifying it as one of the main sources when describing their general tagging processes (see Figures 6.6, 6.8, and 6.13). However, it is uncertain whether the participants who used these system-suggested tags were all agreed on their usefulness. One participant noted that system-suggested tags were not useful, although he identified himself as frequently using the Connotea-suggested tags (Participant 3). This participant reported that when assigning tags he usually followed the routine of first looking up the tags he used previously, and then 'Suggested Tags' by Connotea (see Figure 6.8). However, of Connotea-suggested tags, he remarked that "suggested [tags] are not really suggested

words. If I enter a new key word, connotea doesn't recommend any word".

A participant might have an idea of the type of system-suggested tags that would be useful, but be uncertain as to whether or not such a system-suggested tag existed and/or where it might be found. One participant said that he was not aware of system-suggested tags until he participated in this study (Participant 11). He gave his general thoughts on system-suggested tags provided by CiteULike after completing his questionnaire study:

> I had not previously notice the "suggested tags" feature when I filled out the survey [in participating this study] and wanted to comment on that I find it a nice feature for consolidating tag, but generally prefer to click on the tags in my tag cloud when tagging a newly posted article. But, it would also be nice to have the suggested tags in the "update tags" fields on existing articles in my library, and not just when I post a new article (Participant 11, *Quotes from his email on December 26, 2008, emphasis in original*).

This lack of knowledge or experience also seemed to influence his perception about system-suggested tags. Even though this participant considered using system-suggested tags after learning about this feature, he still had a negative view of system-suggested tags. In his follow-up interview session, he noted that:

> I do not use suggested tags, because my topic tags are already organized in a way that makes sense to me. I do not put a large amount of faith into the tags of others, as different people necessarily organize concepts differently (Participant 11, *follow-up email on December 27, 2008*).

c. Tags generated from other source of related tags: Using the Features of Popular Tags, Related Tags, Recently Used Tags (CN), Popular Bookmarks, Everyone's bookmarks for this Web page (DL), and Find Related articles from this CiteULike Users (CU), and extensions

Some participants were identified as continuing to search for appropriate tags, if they failed in finding any appropriate ones for the bookmark within their personal tag collections and the system-suggested tags (Participants 3, 6, 8, and 12). In such cases, they extended their search for appropriate tags for the bookmark across the folksonomic system. Moving outside the current bookmark, they consulted with tags generated from sources related to the bookmark.

In terms of tags generated from other sources within the folksonomic system, different features were identified: 'Popular Tags',' Related Tags', and 'Recently Used Tags' of Connotea; 'Popular Bookmarks' and 'Everyone's bookmarks for this Web page' of Delicious; and 'Find Related articles from this CiteULike tags' of CiteULike. Qualitative diary studies found that of the 12 participants, four routinely used these features to evaluate and copy tags into the current bookmark (See Figures 6.8, 6.11, 6.13, and 6.18.2). Comments on copying tags from existing tags in this way include the following:

> Sometimes, I'm not sure how to tag something. [For example] I'm not a

> photographer and [am] I really going to need the tag 'lens' again? Likewise […] I think 'Related Tags' of Delicious are useful [to find appropriate tags] as I have on some topics [I'm not familiar with] (Participant 6).
>
> [I look up 'Everyone bookmarks for this Web page' of Delicious to] track my own sites [and] find interesting people or tags (Participant 8).

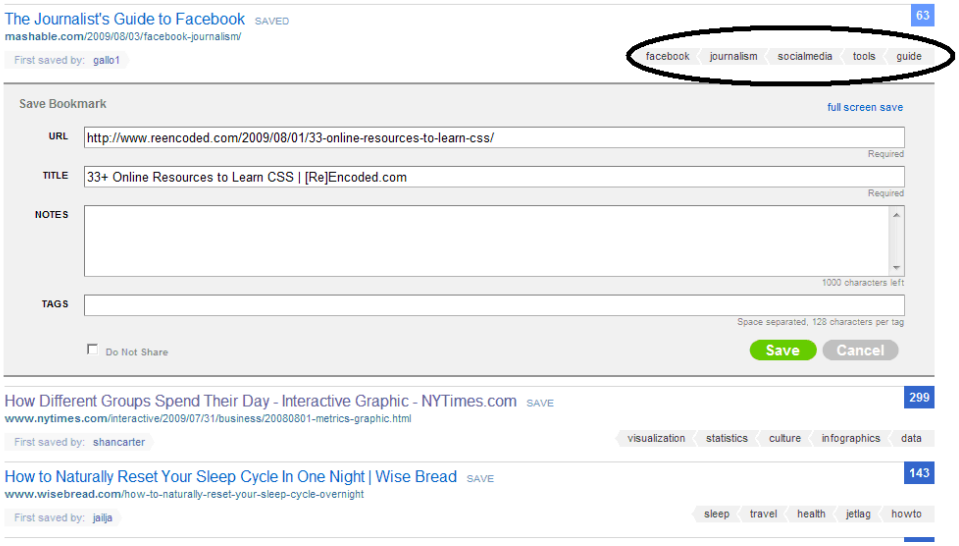
As evident in the quotations, these participants had experienced using these features to find tags which they did not know, which were relevant to the current bookmark. They learned with experience that such features helped them to establish tags for the bookmark, and included the use of those features in their tagging processes.

In particular, Participant 6 described her tagging processes as examining first the existing tags presented in the screen when adding tags to the current bookmark (that is, system-suggested tags). Then, if she did not find any appropriate tags for the current bookmark, she proceeded to review 'Everyone's Bookmarks for this Web page'. Through this feature, this participant could view a complete history of everyone's bookmarks, including who saved this bookmark and what tags they assigned to it. In this way, Participant 6 identified appropriate tags for the bookmark in hand and copied the found tags into her personal library. In the interview session, this participant reported that she thought this feature was useful because "[it] mentions a feature of a site that I haven't noticed yet" (Participant 6). Her Delicious study observed that she used this feature routinely to consult

with and copy tags in her tagging processes (see Figure 6.11).

Another participant noted that he used the feature 'Related tags' of Delicious "naturally following the flow (instead of typing the refinement tag)" in the interview session (Participant 8, see Figure 6.13). However, during the seven-day period of study, his Delicious diary study showed that he rarely used this feature ('Related Tags') in adding tags. Instead, this participant used another feature, 'Popular Bookmark' to consult with and copy tags. His Delicious diary study shows that when he added new bookmarks from 'Popular Bookmark', he tended to copy the tags found there as well as the bookmark (See Participant 8's Delicious diary entries # 3, 9, 10, and 11). As seen in Figure 7.4, when this participant saved a 'Popular Bookmark' to his personal library, the tags assigned by others to the bookmark appeared in the 'Tag Bar' . Consequently, from this 'Tag Bar', he could identify appropriate tags for the bookmark, and copy selected ones into his personal library.

Figure 7.4 Delicious' Display of 'Tag Bar' in Copying "Popular Bookmark' into Personal Library



Participants also might consult with and copy from extensions beyond the folksonomic system in adding tags. Of the 12 participants, one participant (Participant 1) reported that he invented a particular folksonomic system from which he routinely copied tags into his bookmarks in Connotea. He used this extension in the same way as 'Suggested Tags' of Connotea, examining the existing tags to see whether appropriate tags were available for the current bookmark (see Figure 6.5). He spoke of how he copied tags from this extension:

> I was using my extensions […] to add the tags here [Connotea]. The main difference with normal users is that the tag suggestions come from sources outside of my own tag collection (Participant 1, *follow-up email on October 8, 2008*).

His Connotea Diary studies observed that he most often copied tags directly from the extension (of 38 tags, 32 were chosen from the extension) and marked those copied tags as

‘Suggested Tags’. In this respect, this extension was likely to serve as a complement to Connotea when Participant 1 added tags for the bookmark.

(2) Generate a new tag

Generating a new tag was usually followed by consulting with and copying from existing tags. Participants commonly observed that, if unsuccessful in the search for appropriate tags from the existing tags, and having exhausted all the possible tags there, they would generate an alternative expression for the current bookmark. This quotation illustrates how participants generate new tags:

> I look up my tag cloud and choose the appropriate ones. If I can’t find the appropriate one, then I add a new tag that is needed (Participant 12).

Qualitative diary studies revealed that participants also used the features of folksonomic systems while generating tags: ‘Popular Bookmark’ and ‘Everyone’s Bookmarks for this page’ in Delicious; and ‘Find Related articles with these CiteULike Tags’ in CiteULike. As already noted, some participants have learned with experience that such features can indicate some aspects of the bookmark they had not considered before, but which might be relevant to it (Participants 6, 8, and 12). This guided them to generate new tags as well as to copy the selected tags to the current bookmark.

For example, the participant quoted above observes that in her general tagging processes she reviews her tag cloud first and then uses such features to identify appropriate tags for the bookmark in hand (Participant 12, see Figure 6.18.2). In the interview session, this participant reported that the feature, 'Find Related articles with these CiteULike Tags' helped her to generate new tags (Participant 12). While reviewing the tags assigned to the bookmark by others, she might have an idea about potential tags for the current bookmark. She appreciated finding information, the value of which was unanticipated, in this way:

> I found several times useful tags through looking up [the feature, 'Find Related articles with these CiteULike Tags']. I think it [is] really useful to see what's going on widely in [the topic related to the current bookmark]. I could find something really new I didn't expect but related (Participant 12).

Another participant also identified the feature 'Popular Bookmark' of Delicious as helping him generate new tags for the bookmark (Participant 8). As already noted, if he did not find any appropriate tags for the current bookmark by searching within the existing tags, he returned to 'Popular Bookmark' to identify appropriate tags for the bookmark (see Figure 6.13). While reviewing the tags already assigned through 'Popular Bookmark', he compared the information found there to the bookmark in hand. By examining bookmarks with those tags, he was able to come across additional information and consequently generate alternative tags. For those newly-generated tags, he said that 'Popular Bookmark'

"point[s out] the [additional] aspect of" the bookmark to explain why he added those tags in his Delicious diary study (Participant 8, diary entry #11 and #12).

7.2.3 Review assigned tags

As noted earlier, a new concept "review assigned tags" was identified as a previous step in the decision about editing tags during tag assignment. In terms of participants' review of assigned tags, two different types of reviews were identified: the completion of tagging and verification of assigned tags.

During tag assignment, participants reviewed whether the tags assigned have fully described the bookmark. If more tags needed to be assigned to the bookmark, the above processes were repeated several times, comprising a series of repetitions of examination of the bookmark, identifying tentative tags and searching for appropriate tags. Participants would examine the bookmark closely to determine what element was missing, and their review continued until they thought the assigned tags were enough to provide the necessary information about the bookmark (see Figures 6.5, 6.6, 6.7, 6.9, 6.10.2, 6.11, 6.13, 6.14, 6.15, 6.16.2, 6.17, and 6.18.2). This type of review guided participants' decision about adding

more tags to the current bookmark. Indeed, in her Connotea diary studies, one participant identified her reason to add new tags as to "supply more information" about the bookmark (see Participant 4's Diary entries #7, 8, 10, and 11).

Their review of tag completion was also associated with their decision about the number of necessary tags. Statistical analysis found that the 12 participants assigned a mean of 4.3 words per bookmark they saved. The mean number of tags which each participant assigned to a single bookmark ranged from a maximum of 7.0 words (Participant 11) to a minimum of 2.9 words (Participant 9). The following quotations come from participants who spoke of the number of tags they thought necessary:

> […] I try to add three or more tags that would enable me to easily remember what the article is about, after reading the tags (Participant 2).
>
> [I realized that] over time, the number of tags could become a problem – one might be scanning a very long list of tags to get to source- but maybe there is a way of organizing tags too (Participant 4).
>
> […] I choose the best 4-6 tag (Participant 8).

In addition to the number of assigned tags, participants also evaluated the completion of other elements associated with the activity of tag assignment. For example, Participant 11 said that he checked if the current bookmark was necessary to add additional notes at the review stage (see Figure 6.17). When he decided to add notes to the bookmark, he

distinguished between private and public depending on the bookmark. He said that "I do create [a] private note that remind[s] myself why I posted the reference" (Participant 11). His CiteULike diary study showed that he most often posted public notes and only occasionally posted private notes (He posted two private notes and eight public notes for the total of 11 bookmarks he saved).

As well as tag completion, participants also described their review for the verification of the assigned tags. A number of participants noted that they reviewed the assigned tags to see whether the assigned tags were appropriate to describe the bookmark, or whether editing of tags was necessary (Participants 2, 3, 4, 6, 7, 9, and 11). In many cases, participants' review for tag verification referred to the assessment of the subject matter of the bookmark. Participants reviewed the assigned tags to see if they represented the subject content of the bookmark fully and correctly. When reviewing the group of assigned tags, they might notice that a few tags were not relevant to address the subject matter of the bookmark. For those tags, one participant cited "wrong tags" (Participant 2). In the follow-up interview, he spoke of the reason why he thought that tags was wrong:

> It seemed that I added these tags for error. I remember that I was in a hurry when I added them, and I didn't notice that they [had] nothing to do with the article. I noticed that they were wrong […] (Participant 2, *follow-up email on*

December 1, 2008).

Participants also sought confirmation by searching for the assigned bookmark in the folksonomic system (Participant 7) or by using another search engine such as Google (Participant 1). This type of review was associated with participants' tagging motivations to reuse information. For example, Participant 7 observed that while reviewing tags, he checked to see if the assigned tags would retrieve the current bookmark easily in Delicious (see Figure 6.12). If that failed, he considered refining the tags. He reported that he repeated this process of review so that the assigned tags served to "display and find bookmarks on [my library]" (Participant 7). The other participant (Participant 1) also said that he used "Google to look for something I've tagged" first; and he reconsidered tags with "re-finding attempts (when [G]oogle fails [to find the item])" (Participant 1).

As is evident in these quotations, there would appear to be a logical link between participants' tagging motivations and their review of tags. Participants with tagging motivation for sharing with others usually reviewed the assigned tags to see if they were useful or meaningful to communicate with other (Participant 3, see Figure 6.8). Participants with tagging motivation for creating personal references tended to evaluate the assigned tags by comparison with other tags in their own tag collections (Participant 6, see Figure

6.11). Participants with tagging motivation for information reuse (later reference) considered whether the assigned tags were useful for the identification and retrieval of the bookmark (Participant 4, see Figure 6.9).

7.2.4 Edit tags: Rename or delete tags

Review of the assigned tags guided participants' decision about editing tags. Decisions were made about what tags they wanted to edit – did they want to change the tags or not? This determined whether they would rename, delete or leave tags intact. In terms of editing tags, two categories emerged from the analysis: participants replace the assigned tags to the bookmark with other tags (rename a tag), or they remove the assigned tags from their personal library (delete a tag).

A commonly cited way of editing tags was renaming the tags identified as inappropriate. Qualitative diary studies showed that participants' decisions about renaming tags were most often related to their review of tags describing the subject matter. The following quotations illustrate this category of tag editing:

> I first tagged this item as 'structure', then I renamed the tag to 'structure software' (Participant 2, Diary entry #6).

> I would used “sensor networks” but the space is a delimiter [so I renamed it as ‘sensor-networks’] (Participant 7, Diary entry #1, emphasis in original).

As is evident in the quotations, after renaming, tags were more specific than those originally assigned. This was because participants renamed the tags in order to represent the bookmark more accurately or fully (Participants 2, 3, 4, 6, 9, and 12). In particular, one participant linked his decision about renaming to tagging for social sharing purposes:

> I would make it more specific, in consideration of the potential of sharing with others. I wanted to reorganize all related items under the tag of [the revised word] so that other[s] could also find it more easily (Participant 3, *follow-up interview on December 28, 2008*).

In contrast, other participants’ decisions about renaming tags were associated with their personal management purposes, in other words, reorganization of their personal tag collections (Participants 4 and 6). These participants commonly decided to rename a few tags by comparison with other tags in their tag collections. They renamed and reorganized tags in consideration of “easier identification” or “retrieval purposes” of the bookmark in their personal library.

After review, participants occasionally deleted the tags which they considered to be neither necessary nor appropriate. They talked of, for example, tags which “overlapped (Participant 3) or were assigned “by mistake (Participant 12)” which they would delete. In particular, one participant noted that he deleted the tags by comparison with other tags in

his tag collections (Participant 3, diary entry #24). In the follow-up interview, he remarked on the reason why he decided to delete the tag:

> This web site provides information about ESOL. I deleted this tag because I thought it was overlapped with other tags about [that topic]. I realized that I already had other tags related to this (Participant 3, *follow-up interview on December 28, 2008*).

In at least one case, a participant decided to leave tags, which were considered as not appropriate to represent the bookmark, intact, although it was unusual for participants not to revise tags identified as inadequate. Of 12 participants, one participant stated that he decided to leave the tags he perceived to be "wrong" without editing them in his personal library (Participant 2). As noted earlier, this participant recognized specific tags were wrong: in his Connotea diary study, he said that "I should not have used it" (Participant 2, diary entry #10) because "[the tag is] not particularly related to" the subject matter of the bookmark (Participant 2, follow-up email on December 1, 2008). In spite of this judgment, Participant 2 decided not to change the wrongly-assigned tags. About this decision, he explained:

> Maybe a better tag could have been genomics. However, it won't hurt me to keep this tag on this article, so I won't change it, at least unless I will read the article again (Participant 2, *follow-up email on December 1, 2008*).

This tag was distinguished from other tags which he identified as inappropriate and

consequently renamed. This participant's decision about leaving the tags identified as wrong might depend on his familiarity with the subject matter of the bookmark. He may have been uncertain about the topic of the bookmark since he noted that "I heard about it in a seminar" and "I will give it a look later" in his Connotea diary (Participant 2, diary entry #3).

7.3 Tag searching/ discovery

Tagging activities related to tag searching or discovery included:

- browse tags:
    - browse the most popular or recent tags; or
    - browse related tags; and
- search for a specific tag

Unlike other tagging activities, the activities related to tag searching were not identified in the sequence of steps in their tagging processes. These activities occurred sporadically and were most often linked to other activities. This section, therefore, discusses the way in which they discover or search for a specific tag in their tagging processes as perceived and observed by participants.

As data analysis proceeded, the initial concepts and categories relating to the activity of tag searching and discovery were reorganized and classified into two major concepts: browsing tags and searching for a specific tag. The initial concepts of "see others'/popular tags" and "navigate related tags" were merged into one concept, "browse tags". On the other hand, the concept "search for a certain tag" was moved from the activity of item selection in the initial coding schemes.

7.3.1 Browse (popular/ related) tags

During tagging participants browsed the tags which other users of the folksonomic system assigned, thereby possibly discovering new information in the folksonomic system. This type of tag searching is indirect and passive, in that participants were probably monitoring what was available rather than engaging in the direct search for a specific tag. In this respect, the concept, "Browse others' tags" is considered as opposed to "Search for a specific tag" which will be discussed in Section, 7.3.2 Search for a specific tag.

As data analysis proceeded, a number of categories were identified relating to how participants browsed tags which other users of the folksonomic system used. The emergent

categories entailed both the nature of the activity as well as the features of the folksonomic system that participants used during browsing tags.

(1) Browse the latest or most popular tags (using the popularity feature of the folksonomic system)

Participants browsed a set of the latest or most popular tags used to describe all the bookmarks posted to the folksonomic system while tagging. These lists of tags were displayed on the front page of the folksonomic systems CiteULike and Delicious, and on the 'Popular links' page on Connotea.

In many cases, participants' activities of browsing the lists of most popular tags were linked to the stage of item selection in their tagging processes. A number of participants observed that they browsed the lists of most popular tags in order to collect the "latest" references that they were interested in (Participants 8 and 11); or "relevant" references of which they might have been unaware (Participants 2 and 12). During the period of the study, however, the activity of browsing the lists of most popular tags was rarely observed in the qualitative diary studies. Only one participant of the 12 was observed to add a new bookmark while navigating through 'Popular Bookmarks' (Participant 8, see Figure 6.13).

He occasionally browsed the lists of tags on 'Popular Bookmark' in order to see what other Delicious users had bookmarked; in this way, he found a few interesting bookmarks and copied them into his personal library. (During the seven-day period of study, four bookmarks were copied in this way of the total of 11 bookmarks which he added).

The activity of browsing the lists of popular tags was linked to participants' tag assignment as well as to their item selection. Participant 8 also reported that when he browsed 'Popular Bookmark' on Delicious to find appropriate tags for the bookmark during tag assignment, he could find not only interesting bookmarks but also appropriate tags for the bookmark (see Participant 8's Delicious diary entry #3, 9, 10, and 11). Participant 12 also reported that she usually browsed 'Everyone's Tags' in adding tags to the bookmark. Even though her CiteULike diary observed that she did not add bookmarks while browsing 'Everyone's Tags' during the seven-day study period, this participant again mentioned it in the follow-up interview session:

> [Popular tags] is helpful to see what tags other people use- sometimes other people come up with a better term for something that I would like to identify as well (Participant 12, *follow-up interview on January 29, 2009*).

(2) Browse related tags (using the features of link to related information provided by the folksonomic system)

As well as popular tags, participants also navigated the related tags in order to discover information that was relevant to their area of interest but of which they might have been unaware. The folksonomic systems provided links to related information through several features: 'Related tag names' and 'Related user names' on Connotea; 'Related tags' and 'Everyone's bookmarks for this Web page' on Delicious; and 'Related tags', 'Find related articles with these CiteULike tags', and 'Find related articles from these CiteULike users' on CiteULike.

The activity of browsing lists of related tags was identified, linking to two stages in participants' tagging processes: item selection and tag assignment. In terms of navigating related tags, participants talked of, for example, "serendipitous discovery" (Participant 1), "see[ing] if something interesting has been posted" (Participant 2), or "mechanism for constraining searches" (Participant 8) in order to find resources which were relevant to their interest. In particular, one participant noted that:

> [I used 'Related Tag' like that] as we search for articles from databases, we use thesauruses. I think it is applicable to tagging system [when I browse related tag to the current bookmark] (Participant 3).

Indeed, his Connotea diary study found that he used 'Related Tags' most frequently in

adding bookmarks: during the seven-day period of study, 33 bookmarks were copied into his personal library in this way, of a total of 38 bookmarks which he added.

In addition to item selection, the activity of navigating the lists of related tags was linked to tag assignment in the tagging process. The participant quoted above browsed 'Related tags' in order to identify the appropriate tags for the bookmark, and then copied the found tags into his personal library (Participant 3, see Figure 6.8). Another participant also reported that she browsed 'Find Related articles with these CiteULike Tags' while assigning tags which could generate new tags for the bookmark (Participant 12, see Figure 6.18.2).

7.3.2 Search for a specific tag

Participants also searched for a specific tag during tagging. The activity of searching for a specific tag refers to entering a subject or keyword query for the candidate tags in the folksonomic system. This type of searching is relatively active and focused in that participants were engaged in a direct search for a specific tag, in contrast to browsing the lists of available tags.

Participants commonly claimed that they searched for a specific keyword (tag) in order to find the articles most relevant to their interests (Participants 7 and 12). They talked of, for example, "exact" or "specific" information they wanted when searching for a specific tag. In particular, one participant reported that she preferred to restrict her searching by using the search feature of CiteULike (Participant 12). In the follow-up interview session, she went on to say:

> Searching [through the features of CiteULike] is interesting, but sometimes [a] waste of time. Tag names didn't give me exact information [I wanted]. I need a more specific search to find something in particular (Participant 12, *follow-up interview on January 29, 2009*).

The activity of searching for a specific tag was most often linked to the stage of item selection in participants' tagging processes. While searching for a specific tag in the folksonomic system, participants might identify a few relevant bookmarks and copy them into their personal library (see Figures 6.12 and 6.18.1). Qualitative diary studies revealed that these participants tended to expand their search for resources relevant to the current bookmark with direct searching for a specific tag (see Participant 7's Delicious diary entry #2 and Participant 12's CiteULike diary entry #4). This searching for a specific tag would be also followed by further search and review of the bookmarks under that tag (see Figure 6.18.1).

7.4 Other tagging activities

The flowcharts developed from each participant's tagging process showed that tagging was a quite complex process, comprising a series of activities. Most of participants' subsequent tagging activities fit into the three concepts and emergent categories: item selection, tag assignment, and tag searching. However, some activities were identified which did not fit into any of the other categories presented in the flowcharts of the tagging process. These activities were observed very rarely among participants, and it was difficult to identify any further relationship with the rest of the tagging activities. Therefore, a new concept "other tagging activities" was established to include the activities observed in participants' tagging process other than those classified into the three main categories (i.e., item selection, tag assignment, and tag searching).

During the period of the study, two different activities were observed by two different participants. One participant reported that he added a new member to the Connotea group which he set up relating to his research (Participant 1, see his Connotea diary entry #10). This activity was related to the experience of community participation which might influence the participant's other tagging activities such as item selection, tag assignment, or

tag searching. However, during the period of the study, any relationship between this activity of adding a group member and other activities was not identified.

Another participant reported that he edited one bookmark during the period of study (Participant 2, see his Connotea diary entry #19). This participant found that the bookmark, which he had previously saved in his personal library, had been updated at that time of the study, so he edited the information about the bookmark, changing the title to update it. However, no change associated with the tags nor any link to other tagging activities was identified.

7.5 Conclusions: Tagging processes

This chapter presents findings from the analysis of participants' tagging processes and activities involved when they assign tags to Web resources. The tagging processes of 12 participants were presented in flowcharts in Section 6.3, illustrating individuals' models based on processes by which they classify Web resources and the activities involved with tagging. Analysis of the flowcharts developed from 12 participants showed that tagging was a quite complex process, comprising a series of activities. Three main tagging activities involved in the tagging process have been identified: item selection, tag assignment, and

tag searching and discovery. Although the process begins with the item selection, the stages that participants follow are not linear. In particular, the activities related to tag searching were not identified in the sequence of steps in their tagging processes, and occurred sporadically. The entire process of tagging is a very complex one, in which each tagging activity is interconnected, and a variety of folksonomic system features are employed.

Chapter 8 explores participants' motivations behind tagging activities and the types of tags they used, and discusses how participants related their motivation to the tag decision made in tagging.

8 FINDINGS AND DISCUSSION: TAGGING MOTIVATION AND TAGGING DECISIONS

8.1 Tagging motivation

To address research question two, the tagging motivations of 12 participants are analyzed and described according to three main concepts, which were derived from the conceptual model. These three main concepts related to tagging motivations emerged initially from the analysis: managing personal information only, sharing information with others (group or work-related) only, and using for both purposes. As data analysis proceeded, these three main concepts were further specified and defined in a number of categories. The themes listed below were identified to represent tagging motivations, that is, why folksonomic system users tag a specific resource (Table 8.1).

Table 8.1 Tagging Motivations

Motivation	Sub categories
Reuse Information	Store for later retrieval/ reference Ease of access for potential future use
Keep track of information	Keep track of individual's own progress/ information Keep track of similar-minded people
Manage reference	Create/ maintain personal references Collaborate to create/ maintain group references
Share information with others	Share with colleagues, students (work-related, teaching-related)
Communicate with others	Express individual's own opinions about the tagged bookmark Network with similar minded people Advertise his/her paper to others
Explore information	Browse interesting information Search for specific information
Organize information	Keep related bookmarks together

Seven different motivations behind tagging activities were identified: reuse information; keep track of information; manage references; share information with others; communicate with others; explore information; and organize information.

A number of participants used terms which indicated "reuse information" when they described their motivations to tag a given resource. Participants talked, for example, of "finding sites I've seen before", "later reference", "future use" or said that they tag a specific resource in order to make it more findable and easily accessible. The quotations below illustrate these tagging motivations to reuse information:

> This is a tutorial and an important resource about bioinformatics and scientific programming. I will use this link to prepare a seminar about good practices in bioinformatics next week (Participant 2, diary entry #8).
>
> […] lists some tools I haven't tried that I may end up testing to review (Participant 5, diary entry #14).
>
> I want to look back at this for reference purposes (Participant 6, diary entry #39).
>
> Someone I know mentioned it, my memory is bad and it took ages to find so I wanted to keep a link to it (Participant 7, diary entry #7).
>
> […] mark for future reading and referencing (Participant 10, diary entry #2, 3, 4, 6, and 7).

In many cases, tagging for reuse of information is associated with participants'

expectations of new, unanticipated discovery of relevant resources in the future through tagging. Some participants appreciated the advantages of finding related resources together with a given resource as well as the tagged resource. Indeed, they expected that they would be able to explore relevant resources along with the tagged resource when they revisited. Related to this issue were comments one participant made:

> I've been following the campaign that the link concerns and wish to find related stories to this topic (Participant 6, diary entry #4).
>
> I want to find similar items in the future and be able to find this article among all my other bookmarks (Participant 6, diary entry #30).
>
> I want to find this item in the future and reread the rest of these fairy tales (Participant 6, diary entry #32).

The participant quoted above stressed her tagging motivation for reuse of information, that she wanted to find related resources with "the click of a mouse" on a tagged one. The following quotation describes the same phenomenon by another participant:

> I use this site all the time before I deleted all my bookmarks to start again, I had loads of pages from this site, now I just want one link and search for what I need (Participant 7, diary entry #9).

Participants' comments about tagging motivation to "keep track of information" were of two types: keeping track of their own progress or information, and keeping track of similar-minded people such as related researchers or their laboratory colleagues. The following two

quotations illustrate the first of these subcategories -- i.e., keeping track of their own progress or information:

> Tagging or social tagging systems help people [keep] track with their information.
> [I am tagging this item] to keep record for the article information for further research (Participant 3).

> Keeping track of all the things I've found interesting and want to keep without cluttering up my browser favorites (Participant 12).

Participants also described their tagging motivations for keeping track of similar-minded people. The following quotations emanate from participants who spoke of keeping track of similar-minded people via an RSS feed subscription which the folksonomic systems provided:

> […] the RSS feed to the group provides an easy way to watch what other labmates are doing (Participant 1).

> My purpose, on the other hand, is to manage my reference library. I do find it interesting to follow what related researchers (defined by my CiteULike neighbors) are reading (I subscribe to their feeds) (Participant 11).

Social networking was also reported as tagging motivation for keeping track of similar-minded people:

> [I tagged this item because] this is my personal social networking and I access this site frequently (Participant 3, diary entry #34).

> […] keep track of social networking sites in medicine (Participant 5, diary entry

#8).

Another participant spoke of adding a thread of a forum in his bookmarks to keep track of similar-minded people:

> I have played the game a lot and want to see what player created modules are available to change the game. This thread at a forum discusses the most popular. I often bookmark forum threads that I like, because with most forums you have no chance of finding it again with their search engines (Participant 7, diary entry #5).

Maintaining references was acknowledged by a number of participants as one of their tagging motivations. Examples of maintaining or creating references include the following:

> Create and maintain a bibliography of articles and web pages related to my scientific activity. […] allow me to easily create a bibliography for an article I am writing (Participant 2).
> […] collect information on scholarly communication, esp. as relates to new media (Participant 5, diary entry #17).

> […] help me group and sort my references easily, help me locate them easily, help me export them easily, keep all references neatly categorized, [and] help me digest information easily (Participant 10).

> My purpose, […], is to manage my reference library. I do find it interesting to follow what related researchers (defined by my CiteULike neighbors) are reading (I subscribe to their feeds). However, the most valuable aspects of CiteULike for me are 1) the browser bookmarklet that quickly gets a new reference into my library and 2) the fact that my references, and associated PDFs, are stored centrally and that I can access them from anywhere (Participant 11).

The last participant quoted above, in particular, reported that she tagged resources which

she would cite in her research paper in CiteULike. She linked her tagging motivation for creating her personal references to the way in which she classified a given resource in a specific category:

> The purpose [of] my library is to make it easy to search for papers and to read them and cite them when I am writing an article. This is why a more task-oriented or project-oriented approach is most relevant for managing my personal library (Participant 11).

As well as maintaining personal references, collaborating on creation of references with colleagues or groups is cited. One participant commented on his tagging motivation for maintaining collaborative references with colleagues:

> The people with whom I am sharing references collaborate with me on specific projects […]. We bookmark, share, and discuss references at office meetings. We collaborate and brainstorm new ideas in the field via reference discovery (Participant 10).

As is evident in these quotations, collaborating on creation of references with colleagues or groups fosters sharing resources with others. A number of participants reported that they tagged resources in order to share them with others, for example work-related colleagues or students of the class which they teach:

> For a journal club, I have to check some journals on [our research area], and if I find some interesting article, propose it to a journal club (Participant 2, diary entry #10, 11).

> […] sending it to friends (Participant 5, diary entry #3).

> […] share with IE users (Participant 5, diary entry #9).
>
> I believe that the purpose of citeulike is a service to organize and share bibliographic references. The main use for me is to share papers with my colleagues and students (Participant 9).

Communication represented another tagging motivation for a number of participants. Some participants spoke of their tagging motivation for communication in a general sense of "sending a signal to others" or "expressing their own opinions to others":

> [I tagged this item] because I thought it was interesting and wanted to signal that to other[s] (Participant 1, diary entry #5).
>
> I have noticed that the previous bookmark I added to connotea pointed to an older version of the program. There is also another user that bookmarked this url, and I would like to send him a message to tell him […] (Participant 2, diary entry #19).
>
> Sending a pointer to this paper to one of my PhD students (Participant 9, diary entry #2, 3).

Some participants acknowledged the communicative nature of tagging and attempt to express themselves or their opinions through the tags they choose. This participant, for example, had learned over the years the advantages of promoting his paper using a folksonomic system. He commented on his tagging motivation for getting people to look at his own paper by intentional tagging:

> [I tagged this item because] it cites one of my papers; [I] want to advertise it to

my friends (Participant 1, diary entry #11).

Commonly the tags for opinion expression are ones which convey value judgments that they wish to share with others, such as "interesting" or "important". This is an example:

> [I] share my opinions on articles with other scientists and [through shared opinions I] possibly discover other interesting publications (Participant 2).

Such apparent tagging for communication could also foster exploring of related resources in the folksonomic system. Indeed, tagging motivated by communication and sharing could co-occur with the motivation of information exploration. These quotations were perceived as indicating tagging motivated by exploring information:

> After entering a few references, I began to think that was [a] good system for collecting references and then for being able to find via a tagging system (Participant 4).

> New article discovery through peers (Participant 10).

> I can take a look for something related to the stuffs in [my research area…tagging] makes me fun having unexpected information but related to the subject (Participant 12).

This exploring motivation is based on participants' awareness of the social aspects of a folksonomic system. Some participants link their tagging motivations for exploring related resources with the social aspects of a folksonomic system:

> I can see what other people are bookmarking, and they can see what I am bookmaking [that is] sharing knowledge. It means you don't have to stay on the top of every source when you trust someone in your network to help you find

stuff you may have missed (Participant 5).

> I believe that Delicious is a website that allows users to share interesting websites that they've found with others. During my time at Delicious, I've discovered many interesting pages through the home page that I otherwise would not have discovered. This social aspect though hidden, is what make[s] Delicious a social bookmarking site […] Delicious allows users to access and share information quickly and detect trends and new and interesting sites easily as these sites are often the ones that pop up on the home page (Participant 6).

Others referred to organizing information, that is, keeping related items together, as a key tagging motivation. In many cases, this motivation for organizing information was described with the concept of "categories" or "folders". Quotations that illustrate these organizing motivations were:

> Social tagging system is very useful to sort each resource into some categories (Participant 3).

> What I would like to be able to do in Connotea is to organize information by project (basically by folder) (Participant 4).

> […]group article with other similar articles according to common themes (Participant 10).

> I want to keep all related articles to this as folders (Participant 12, diary entry #7).

8.2 Types of tags: Function of tags as perceived by participants

The types of tags that participants used during tagging were analyzed and described in

seven main categories, which were adapted from those of Golder and Huberman (2006): (1) topic; (2) format; (3) source; (4) refining; (5) qualities; (6) reference; and (7) task-organizing. These seven main categories were described and specified along with supporting quotations from participants. A description and discussion of each category includes participants' comments addressing the functions they perceived their tags performing as well as a discussion of the ways they related their tagging motivations to their tag decision while tagging.

8.2.1 Topic tags

Topic tags refer to tags which participants used to identify what the bookmark is about. Participants were aware of how critical topic tags were to provide access to their bookmarks. They felt that the appropriate assignment of topic tags led to successful sharing their bookmarks as well. Participants spoke of topic tags, in a general sense, as "the basic way of organization" (Participant 4), or "a must to define a resource" (Participant 8).

In terms of topic tags, participants categorized their bookmarks through content with different degrees of specification relative to different dimensions. Depending on participants' ways of categorization of the bookmark by tags, topic tags might establish a

hierarchical or horizontal structure. The first of these categories – i.e., the hierarchical structure with topic tags— referred to those who planned to organize their tags by the breadth of the subjects prior to tagging (Participants 1, 2, 4, and 7). These participants commonly discriminated between general and specific topics. To represent the hierarchical relationships between individual tags, they defined "general" (Participant 1 and 2) or "overarching" (Participant 10) topics first in the description of tags they used in their diary studies. Then they assigned specific tags under these general topic tags, generally using compound words. Examples of the topic tags which participants used to represent the hierarchical relationships between individual tags through tagging include:

> Dewey Decimal Classification: subject
> LibraryThing: author/subject
> Social tagging application: subject
> Social Semantic Web: subject/ "general"
> (Participant 1, diary entry #6, emphasis added).

> Genetics software: This bookmark is the home page of software used in genetics
> Population genetics: This is about pop[ulation] Genetics
> Software: This is the home page of software
> Structure software: I am going to collect all the articles/resources that make use of this software under this tag
> LD: This software calculates Linkage Disequilibrium
> (Participant 2, diary entry #6).

games: It's "primary subject" is a game, and I want it to be in my game 'folder'(tag) so that I can easily find it again
baldurs_gate: That's the game, and so I can find anything easily without searching to do with baldur's gate I have created this new tag
rpg: It's a role playing game
(Participant 7, diary entry #1, emphasis added).

breast cancer: "Overarching theme" is breast cancer
inflammatory: Type of breast cancer discussed
(Participant 10, diary entry #3).

Participants might also use a set of topic tags in order to represent the different dimensions of the bookmark through tagging without any concern about the degree of specificity (Participants 5 and 6). In such a case, participants divided the subject matter associated with the bookmark into a few topic tags in order to represent each aspect of the bookmark. Then, they combined these topic tags to provide a more specific (precise) description of the bookmark. They usually referred to these topic tags as "parts" (Participant 5) or "facets" (Participant 6) of bookmark description. The following are examples of topic tags worked out by one participant:

Consumer: part of my consumer health tag […]
Health: part 2 of my tag to describe consumer health
Search: my catch-all tag for search-related topics
Information: part of a 2 part tag information behavior
Behavior: part 2 of information behavior tag (Participant 5, diary entry #2).

Social: part 1 of 2 part tags to describe social networking

Networking: part 2 of social networking tag […] (Participant 5, diary entry #9).

The first quotation indicated the way in which this participant represented the bookmark for health information-seeking behavior of consumers, and the second one for social networking using topic tags.

As noted in the Chapter 6: Findings and Overview of the Results, qualitative diary and questionnaire studies found that topic tags were the most often-used tags by participants (see Figure 6.1 Total Types of Tags Used by 12 Participants Based on Their Diary Studies, and Figure 6.2 The Most Frequently Used Types of Tags Based on Questionnaire Data). The distribution of the participants' response when questioned about the most useful types of tags for different purposes (personal information management and social sharing purposes) also indicated that topic tags were perceived as the most useful regardless of purpose. The following quotations illustrate how participants thought of the function of topic tags relating to their personal information management:

> Using tags that identify topics are useful, because they let you have a picture of what kinds of articles you [are] following and which keywords I am using to search them in [other databases] (Participant 2).

> [topic tags] allow me to quickly find all my saved resources on that particular topic. When I find resources related to my research, this is really helpful (Participant 12).

In addition to their use for personal information management, participants considered the

topic tags to be useful to share with others:

> The topics[…] should be least specific to me and therefore probably the most relevant to the broad community of connotea users –who I do feel like I am sharing with when I bookmark (Participant 1).

> […]topics and themes are the most important factors. I don't recommend any resource to a person who is not interested in the topic. The resource could be great but it is not when it does not intrigue the person (Participant 3).

> I mainly share items with other people because they are interested in the topic (Participant 9).

8.2.2 Format tags

Format tags represent what the bookmark is, in other words, the form of provision of the bookmark. This type of tag takes the form of a reference to the medium of the bookmark concerned, or in which it appeared, such as book, TV, or blog. Examples of tags identified as format tags included the followings: "thesis", "review", "Blog", "article", "tutorial", "Report", and "Syllabus". Analysis of the qualitative diary studies found that these formats tags were the third most frequent type of tags used by participants (see Table 6.2 Summary of Types of Tags Based on the Diary Studies, and Figure 6.1 Total Types of Tags Used by 12 Participants Based on Their Diary Studies).

Participants used these format tags relating to both their personal information

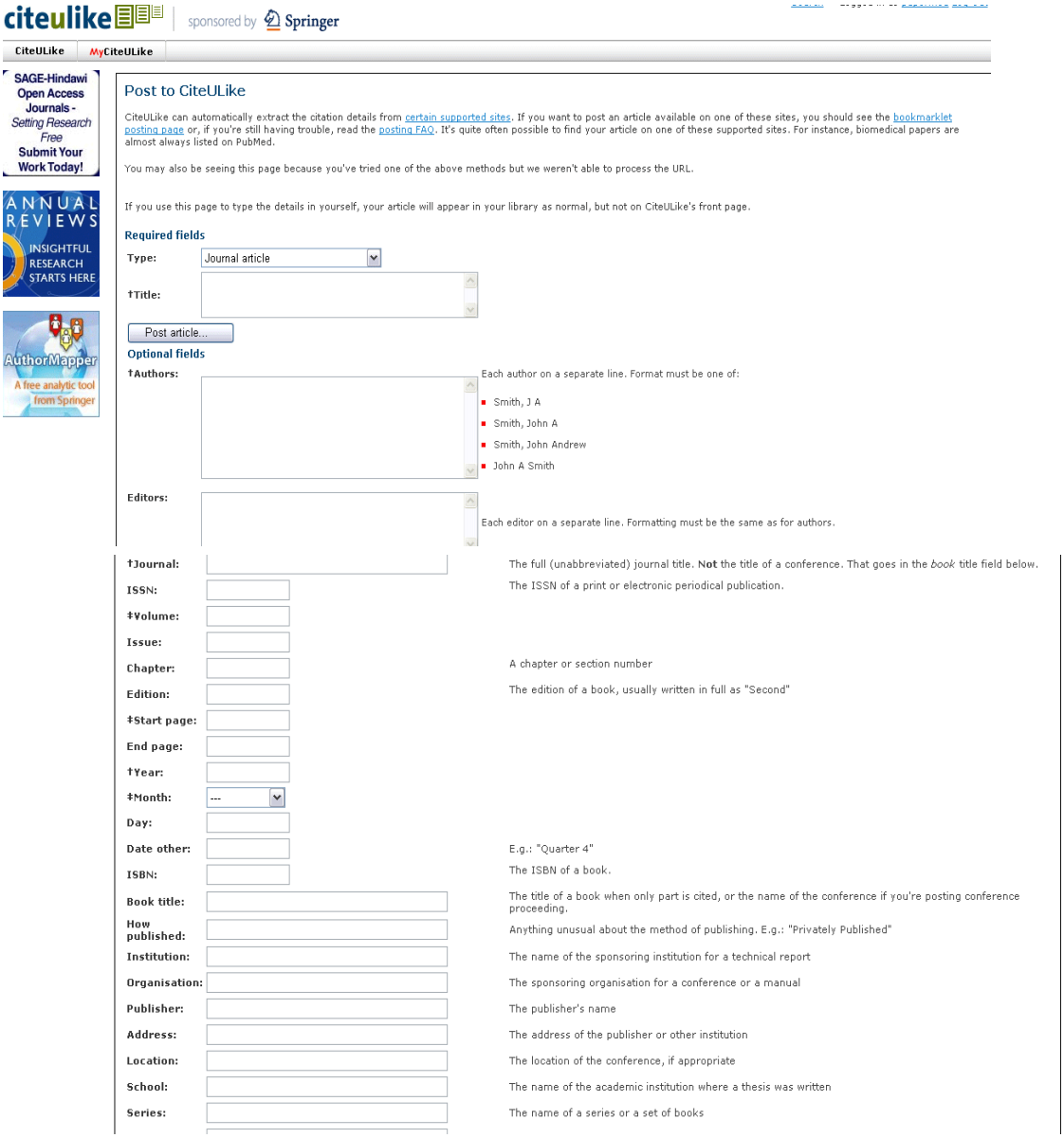
management and social sharing with others. There appeared to be no significant difference between participants' perception of the usefulness of format tags for different purposes (see Figure 6.3 The Most Useful Types of Tags for Personal Information Management Based on Questionnaire Data, and Figure 6.4 The Most Useful Types of Tags for Sharing with Others Based on Questionnaire Data).

For example, in terms of personal information management one participant listed the format tags as the third most useful tags (with topic tags as the most useful and task-organizing as the second most useful tags she reported). She noted that "[a] format tag also helps me find resources quickly because I generally remember resources by types such as books and blogs" (Participant 12). In response to the question about the most useful types of tag for social sharing purpose, she also listed topic, refining, and format tags in order of usefulness. In the follow-up interview session she commented that she thought information about the form of the bookmark would help her find bookmarks interesting to people with whom she wanted to share.

Another participant suggested that the format tag was not strictly necessary in that it overlapped with the citation fields which the folksonomic system provided with the default when adding a new bookmark (Participant 9). In particular, CiteULike required participants

to fill out information about the citation of the bookmark including type, author, title, publication year and so on as seen in Figure 8.1.

Figure 8.1 CiteULike's Display of Posting Articles



Of these required fields, one CiteULike participant remarked that the field, 'type' of the bookmark was "redundant" to the format tags (Participant 9). Indeed, his qualitative diary

study found that he used relatively few format tags. Neither of the other folksonomic systems offered this as a possibility. This might account for the relatively lower total number of format tags in CiteULike compared to those in Connotea or Delicious (see Table 6.2, Summary of Types of Tags Based on the Diary Studies).

However, despite this additional feature of CiteULike, an examination of the lists of tags used by CiteULike participants indicated that the other three CiteULike participants still used the format tags, for example, 'review', 'survey', and 'textbook' (Participants 10, 11, and 12). They may not have considered the CiteULike citation features as a complete replacement for the format tags, nor explored the features fully. For those participants, format tags were considered a way to represent the associated medium of bookmark, which helped make it "easy to search for [bookmarks,] to read them and cite them" (Participant 11).

8.2.3 Source tags

Source tags refers to tags which identify who owns or created the resource. This type of tag also indicates where participants obtained the resource, for example identifying the name of a particular user or publisher. Examples of tags identified as the source tag

included the followings: “Nature”, “in:libraryjournal”, “Library of Parliament”, and “Timo Hanny”.

Participants spoke of the source tag, in a general sense, as a part of the “citation information” of the bookmark, which they perceived to be very important in representing bookmarks (Participants 4, 5, and 9). The following quotations illustrate how participants used the source tag:

> I would indicate whether source came straight off a website or was a journal article from the university’s data collection, or the [associated] project or class name (Participant 4).

> If it’s from a certain source, I’ll always tag it with an in:[XXX]tag. If it’s a journal or magazine article, I always use article as a tag. I only use one [-] word tags, unless it is a name [,for example] natureproceedings or searchwiki (Participant 5).

These participants commonly referred to the source tags as part of their personal information management, which played an important role in recovering their bookmarks in the folksonomic system (Participants 4 and 5). They were aware that the source tags helped them with reusing information (i.e., finding their bookmarks later), combining with other types of tags. In particular, the last-quoted participant commented on her use of source tags:

> I can easily say I want to find all the articles from Library Journal about social bookmarking by combining these types of tag: social+bookmarks+article+in:libraryjournal. It makes it really easy to find stuff

again no matter which way I remember it […] (Participant 5).

As noted earlier, CiteULike's citation features, which a user is required to fill out when adding a new bookmark, might influence participants' use of tags for the format of the source. In terms of source tags indicating who owned or created the bookmark, additional tags were redundant once the CiteULike citation features had been completed, such as 'author', 'editor', 'journal', and so on (See Figure 8.1). This might be one reason that CiteULike participants were observed to use the source tags less often than participants using Connotea or Delicious: the qualitative diary studied revealed that none of the CiteULike participants used the source tags during the study (See Table 6.2, Summary of Types of Tags Based on the Diary Studies).

8.2.4 Refining tags

Refining tags refer to tags which refine or qualify existing tags including numbers, especially round numbers (e.g., 25, 100). In general, this type of tag was not able to stand alone, and was coupled with other types of tags in order to specify the bookmark. Further analysis found that participants used refining tags in three ways: representing geography-specific information associated with the bookmark; representing time-specific tags

associated with the bookmark; and indicating specific features of the bookmark. Examples of tags identified as refining tags included the followings: “July 06”, “Italia”, “music[feature]”, and “2008”.

Participants thought of refining tags differently, depending on their tagging purposes. Their perception of the usefulness of refining tags was slightly different when their purpose was social sharing than when it was personal information management. The distribution of participants’ responses to the question about the most useful types of tags for different purposes indicated that participants answered that refining tags were more useful for social sharing purposes than for personal information management (see Figures 6.3 and 6.4). This suggests that participants might feel that refining tags could contribute to the findability of the bookmarks for someone who might be searching for information on a folksonomic system.

In many cases, participants considered refining tags as supplementary to other types of tags, in particular, topic tags. They felt that these refining tags helped represent the bookmark more precisely, which added an extra dimension to the description of the bookmark. For this reason, refining tags were most often used in combination with other types of tags. The following quotations come from participants who considered refining

tags as a supplemental aid:

> […refining tag] is better if categories are well defined (Participant 2).

> […after Topic tags] my next most used tag type would be Refining [tags] – the only reason I didn't select this one as most used is because one needs a Topic [tag] first before refining it. (this is how I interpret using these two tags (Participant 4).

> […]refining tag helps make sense of the other tags[…]It is easy to deduce that it's relevant to [my interest] (Participant 12).

8.2.5 Qualities tags

Tags identifying qualities of the bookmark included participants' value judgment about the bookmark such as "interesting" "funny" or "important". As Kipp (2007) noted, tags of this type were used to indicate the tagger's emotional reaction to the bookmark, or the emotional reaction they expected to have after putting information in the bookmark into practice. The quotations below illustrate how participants used the qualities tags:

> good: the quality is good so need to be considered citation
> (Participant 3, diary entry #8).

> Amusement: It's funny, and I'll remember it as such
> (Participant 5, diary entry #3).

> Wtf: This article makes me think "What the fuck?"
> (Participant 6, diary entry #5, 8, 18, 20, 21, 33, and 38).

> Awesome: This bookmark is awesome in my opinion

(Participant 6, diary entry #14, and 35).

> Interesting_threads: Sometimes I want to get just see threads that I found interesting enough to bookmark. This tag makes that possible. I always give descriptions to these bookmarks so that I can see what it was about without having to go to the forum (Participant 7, diary entry #5).

As evident in these quotations, participants expressed their personal judgments or opinions about the bookmark through the qualities tags. However, even though they were aware that these qualities tags indicated their subjective reactions to the bookmark, they thought the qualities tags might contribute to social sharing with others in a folksonomic system. It was notable that a number of participants answered that qualities tags were more useful for social sharing purposes than for personal information management purposes. Of the 12 participants, two selected the qualities tags as the second most useful and three selected it as the third most useful in terms of social sharing purposes; whereas only one selected it as the third most useful in terms of personal information management (see Figures 6.3 and 6.4). This suggested that participants viewed the qualities tags not as personal but rather communicable, which possibly informed others about the values of the bookmark. The following quotations illustrate how participants used qualities tags for social sharing purposes:

> [qualities tag] is useful to know which are the best articles, and which are those

> that it is not worth[while] to read (Participant 2).
>
> if people are going to click a link, they want to see what's it about and what emotions the contents of the link will evoke before discovering whether it's a book or list or whether someone intends to read it later (Participant 6).

A few participants also noted that despite the subjective nature of these qualities tags, they found them very useful to find relevant resources from other users in a folksonomic system. If they knew someone who had similar interests to themselves, it led them to discover interesting resources following that person's qualities tags (Participants 1 and 11). These participants tended to rely on others' qualities tags which indicated that the bookmark was interesting and worthy of their time in item selection. Related to this issue were comments the participants made:

> The qualities (e.g., 'important') are probably more important to the smaller community that follows me specifically to increase the likelihood that they will attend to something that I bookmark [than the broad community of connotea users-who I do feel like I am sharing with when I bookmark] (Participant 2).
>
> [qualities tags] may also be relevant, but these are very subjective and require me to first trust the person sharing/posting the article. For this reason, when another person posts, it would be interesting to have quick access to their profile, their history of posts, and also where they are one of my neighbors (i.e., have a library that overlaps my own, to some extent) (Participant 6).

8.2.6 Reference tags

Reference tags referred to tags identifying content in terms of its relation to participants themselves (or taggers) as well the specific users or target audience with whom participants wanted to share. Among the seven categories of Golder and Huberman (2006) which this study adapted, the 'Reference' category was modified to include tags representing any referential relations to the bookmark participants perceived. This was because further analysis identified that it was very rare among participants to use self-reference tags beginning with 'my', for example 'mypaper'. Therefore, reference tags were expanded to include those which participants added as a special tag indicating the referential relations to the bookmark, or tags in the format of 'for:username' in order to send links to other users. Examples of tags identified as reference tags were the followings: "developer", "school teacher", "For:[a particular username]", and "[a name of a particular group participants belonged to]".

Participants used reference tags for their personal information management as well as for social sharing purposes. Some participants presented a set of group-related tags, specifying their group name which represented common themes with the group they belonged to and bookmarks to share with that group (Participants 4 and 10). Other

participants distinguished a particular user name in the format of 'for:[a particular user name on Delicious]' in order to indicate a person to whom she wanted to send links (Participant 5). The quotations below illustrate how such participants used the reference tags:

> [particular group name which the participant belonged to] journal club: I want to propose this paper for a journal club in our group
> (Participant 2, diary entry #10, 11).

> teacher: This web site provides some content for teachers
> (Participant 3, diary entry # 24).

> Green College[12]: Indicates special student group of users. (Indicates the group of students whom I helped on October 09. They were interesting so I would remember to consider this tag if I wanted to find out the items that I helped them find)
> (Participant 4, diary entry #11).

> For:[particular username]: to send to someone else who's interested in web design
> (Participant 5, diary entry #3).

> [particular school name]: this article strikes me as amusing for reasons only [particular school] students would know
> (Participant 6, diary entry #37).

As evident in these quotations, the reference tags were mostly associated with the concept

[12] "Green College" is used as a substitute to reserve the confidentiality associated with the tag Participant 4 assigned.

of “sharing” by participants. They commonly stated that they “wish to share it” (Participant 5) or are “sending [the bookmark] to friends” (Participant 6) while using reference tags. Their comments suggest that participants acknowledged the social aspect of tagging and expected to communicate with other folksonomic system users via the reference tags.

8.2.7 Task-organizing tags

Task-organizing tags referred to tags which were related to performing a task by participants, as well as specifying the associated function with the bookmark. Task-organizing tags were also used to represent specific projects participants worked on, which usually assigned acronyms or tags which looked like university course codes. Examples of tags identified as task-organizing tags included the following: “to read”, “download”, “publication”, “share”, and “cs4302”.

Participants usually used these task-organizing tags as an indicator of what they were working on, in order to find specific information about specific tasks. They talked of, for example, using task-organizing tags “as to[-]do list” (Participant 1), or identifying “the main function” (Participant 3) associated with the bookmark. The quotations below illustrate the function of task-organizing tags participants thought of:

> task organizing tags like to_read function as a to[-]do list for me. I subscribe to my own rss feed associated with that tag [to_read] and try to remove it from things I've read (Participant 1).
>
> […]task-organizing tags are not opinions but are more contextual fact for a single user so they are less useful for other people (Participant 8).
>
> The primary task-related tag I use is "class". When I'm working on my course materials (preparing for teaching class), I use that tag in order to find everything I need for that class quickly (Participant 12, *follow-up interview on January 29, 2009*).

As evident in the above quotations, these task-organizing tags were closely tied to participants' personal motivations, or personal information management. The results of the questionnaire also indicated that task-organizing tags were the second most useful, participants perceived, to manage the bookmarks in their personal collection for their personal use: participants listed topic tags, task-organizing tags, and format tags in order of usefulness for personal information management (see Figure 6.3 The Most Useful Types of Tags for Your Personal Information Management (PIM) Based on Questionnaire Data).

In many cases, task-organizing tags were considered meaningful only to taggers, representing personal relations to the bookmark such as "toread" or "to keep as reference". However, some participants thought of task-organizing tags in a different way (Participants 9 and 10). These participants used the task-organizing tags extending the personal relations

to the point where the collaboration was allowed by a subset of users in the folksonomic system. In such cases, the task-organizing tags were considered to guide collaboration by pointing to the associated tasks of a specific group with the bookmark. They were aware of task-organizing tags as indicators which showed that the bookmark related to specific projects they worked on through collaboration. Therefore, these participants might not perceive a difference between the function of task-organizing tags and that of reference tags. In terms of an indicator of a task associated with a particular group, one participant said:

> The people with whom I am sharing references collaborate with me on specific projects as sub-categories are very helpful[…] Task[-organizing tags] usually indicate which group of people I share my articles with (Participant 10).

8.3 Conclusions: Tagging motivations and tag decision

This chapter presents the finding from the analysis of participants' tagging motivations and types of tags they used that related to the motivations behind tagging activities. Using seven categories of type of tags adapted from Golder and Huberman (2006), the way in which participants related their motivation to the tag decision made in tagging was also explored.

Seven different motivations behind tagging activities were identified: reuse

information; keep track of information; manage references; share information with others; communicate with others; explore information; and organize information. During tag assignment, participants would describe these tagging motivations related to a specific type of tags: topic tags, format tags, source tags, refining tags, qualities tags, reference tags, and task-organizing tags.

Chapter 9 explores how participants understand the social and interactive aspects of tagging, and to what extent they considered others' tags and tagging behaviors during tagging.

9 FINDINGS AND DISCUSSION: SOCIAL AND INTERACTIVE ASPECTS OF TAGGING

9.1 Social awareness and the degree of interactivity

In order to address research question three, participants' social awareness and degree of interactivity are analyzed and described in the major categories related to the features of the folksonomic system that they employed in tagging and tagging activities. Table 9.1 summarizes in diagrammatic form the classification developed from the analysis of the questionnaire and diary studies. These categories are derived from the recurring themes identified in exploring the following questions: how participants consider others' tags and tagging behaviors during tagging, and how this affects their own tags and tagging behaviors.

Table 9.1 Participants' Social Awareness & Degree of Interactivity

		Participants' awareness of folksonomic system features		Impact (observation in tagging process)
		Useful	Not useful	
Degree of interactivity (Participants' experiences of folksonomic system features)	High	• Use all features • Acknowledge social potential of features fully • *Participants 2, 8, 12*		• Add new bookmark • Tag assignment (copy/generate tags)
	Mid	• Use a few features • Have positive expectation on social interaction • *Participant 10 (Link to Related Information)*	• Use a few features • Have negative expectation of social interaction • *Participants 1, 3, 9 (Popularity) Participant 5(Related tag) Participant 6(Exploration by tag/user)*	• Add new bookmark • Tag assignment (copy/generate tags)
	Low	• Never use any features • But acknowledge social potential of features • *Participant 4*	• Rarely use the features • Do not acknowledge social potential of a feature • *Participant 7 (Popularity & Exploration by tag/user.)* • *Participant 11 (Popularity & Link to Related Information)*	

There were participants who showed a relatively high degree of interactivity, using a variety of folksonomic system features during tagging. These participants acknowledged the social potential in using the folksonomic system features fully and relied on them relatively heavily (Participants 2, 8, and 12). These participants talked of, in general, "a channel for discovery of interesting information" regarding three types of folksonomic system features: popularity, link to related information, and exploration by tags or users. They all agreed on the usefulness of each type of feature which led them to discover and explore new topic of interest in tagging.

These participants learned from their experiences that the folksonomic system features helped them with accessing new resources as well as with assigning tags. As noted earlier, qualitative diary studies revealed that these participants frequently used various folksonomic system features in tagging:

- In terms of item selection, they added a new bookmark while navigating through the popularity features –'Popular Bookmarks' of Delicious (Participant 8) and 'Everyone's Tags' of CiteULike (Participant 12) – and the features link to related information – 'Recently used tags' of Connotea (Participant 2); and
- In terms of tag assignment, they also used the popularity features – 'Popular

Bookmarks' of Delicious (Participant 8) – or the features link to related information –'Find Related articles with these CiteULike tags' of CiteULike (Participant 12) as a source to identify appropriate tags for the bookmark.

A number of participants identified themselves as having experience with a few features, but not having fully explored the features of the folksonomic system (Participants 1, 3, 5, 6, 9 and 10, who were placed at the middle of the interactivity dimension). Among these participants, only one perceived a social potential not fully realized and still showed a positive expectation of social interaction in a folksonomic system (Participant 10). The rest of these participants had a relatively negative expectation after a period of experience with a feature (Participants 1, 3, 5, 6, 9, and 10). Participant 10 said that he thought that a feature which links to related users was useful, even though he never used it. This participant reported that he had experience with nearly all features of CiteULike except the feature, 'Find related articles with these CiteULike tags'. About this feature, he went on to say that "I did not know this feature existed". He did recognize that other CiteULike features were useful for "article discovery and new topics of interest" and "[e]xploring missed references in topics of interest […or] newer sources/ journals etc." (Participant 10). From these experiences, he seemed to perceive a social potential fully realized, and consequently had a

positive expectation of social interaction on CiteULike through the unexplored feature, 'Find related articles with these CiteULike tags'.

In contrast, other participants had experience with a few features of their folksonomic system, but found those features were not useful to them (Participants 1, 3, 5, 6, and 9). They mentioned unsatisfactory experiences with at least one feature of the folksonomic system. These unsatisfactory experiences might influence the participants' expectations of social interaction on a folksonomic system. In particular, three participants stated that they found that the popularity features of a folksonomic system were not useful to them (Participants 1, 3, and 9). The following quotations come from participants who spoke of their perceptions of the popularity features:

> Mostly I tag resources according to my needs and I don't care whether it is popular or not [in terms of 'Active users' on Connotea; and]
> Mostly I see resource and determine whether they are useful or not depending on my purpose. Popular resources could be useful to me but not always [in terms of 'Popular tags' on Connotea] (Participant 3).

> I don't need to know what everyone is looking at [through 'Everyone' library' or 'Everyone's tags' on CiteULike…] I am only interested in a subset of citeulike users (Participant 9).

One participant noted that a feature that links to related information, in particular, 'Related user' was not useful to her (Participant 5), saying that "it's not that interesting". In contrast,

she showed a positive reaction to a similar feature which links to related information, 'Everyone's bookmarks for this Web page":

> This is extremely useful. You can figure out what people have to say about your work, what people have to say about resources you're not personally invested in, and you can figure out who has the same interests as you (Participant 5).

Another participant reported that she found the feature of exploration by users not useful to her, saying "I'll click if I'm bored, but otherwise I don't really care if someone likes the same site as me" (Participant 6).

As noted earlier, qualitative diary studies revealed that these participants occasionally used the folksonomic system features in tagging:

- In terms of item selection, one participant was found to add a new bookmark while navigating through the link to related information features, 'Related tags' in Connotea (Participant 3); and
- In terms of tag assignment, they used the features link to related information, 'Recently used tags' in Connotea (Participant 3) and 'Everyone's Bookmarks of this page' and 'Related Tags' in Delicious (Participant 6) as a source to identify appropriate tags for the bookmark.

Some participants rarely used the folksonomic system features, so perceived a social

potential not fully realized (Participants 4, 7, and 11). These participants had either recently begun to use a folksonomic system, so did not perceive a social and interactive component yet (Participant 4); or had abandoned an expectation of social interaction in a folksonomic system after a period of experience with a feature (Participants 7 and 11). Of the 12 participants, only one participant reported that she never used the Connotea features since she began to use the system very recently (Participant 4). She reported that she had yet to get know about the features of Connotea, how to navigate through the system and what features were supported or effective. However, she had experience with other folksonomic systems such as Delicious and Google Bookmarks, from which she learned that folksonomic system features could provide social benefit. Even though she identified herself as having little experience with any features of Connotea, she still had expectations of social interaction on Connotea and perceived a social potential. She spoke of her expectations of the features including popularity, link to related information, and exploration by users of tags, saying that "[these features] could be useful to provide new and more relevant ideas" (Participant 4).

By contrast, other participants had a relatively negative view of the folksonomic system features based on their experience (Participants 7 and 11). These participants had

experiences with at least one feature of the folksonomic system. Both recognized that folksonomic features were not useful to them, and therefore had negative expectations of social interactions through features such as the popularity features of Delicious and CiteULike, the exploration by tags and users of Delicious, and the features link to related information of CiteULike.

Their comments on the popularity features relating to their negative expectations of social interaction include the following:

> Seeing sometimes something useful, or interesting, but it is full of spam, all starting with numbers, like '20 great firefox extensions you can't live without', '10 online tools you never [k]new you needed even though you really do'. These are just dull empty blog articles with links to other popular websites. The blog writer hopes they will bring him more traffic by linking to popular firefox extensions. They annoy the hell out of me, so I no longer look or bookmark links from the popular page, but I still sometimes follow other popular links. Also there is always a high number of geek links there, it's nearly always have made up of computing and web development links which doesn't do much to encourage non-geeks to join delicious (Participant 7).

> [On 'Everyone's library'] signal-to noise is too slow […] My CiteULike profile already contains fields "What I do" and "Interests". The main page should show me articles posted by people who overlap my profile/interest (Participant 11).

> Like all folksonomies, tags are ambiguous [on CiteULike's 'Everyone's tags]. A possible solution [is] to unifying some tags when adding a tag[; and to] provide some kind of auto-complete (a la Google), so suggest popular tags, so that people prefer to re-use established tags. Of course, this should be optional, not

> forced, i.e., I should still be able to continue typing a tag of my own (Participant 11).

In terms of Delicious features, Participant 7 did not perceive a social potential at any time even though he reported that he occasionally used the features, 'Popular Bookmarks', 'Related tags', and 'Everyone bookmarks of this Web page'. He would use those features to refine his own tags for his personal information management purpose, without any perception of social interaction through Delicious. Regarding these features, he said "I'm not interested in this feature" and "in my own bookmarks [I think it useful in] that I can refine my display of tags when looking for something" (Participant 7). Another participant also commented on CiteULike features:

> [In terms of the feature of exploring by tags] potentially useful, but the problem is, the only time other users use the same tags is when the tags are very generic (i.e., algorithm, review). Finding other "format" tags is not relevant for my research, I need to find other "topic" tags, but these are, as mentioned, too ambiguous.
>
> [In terms of the feature of exploring by user] once I have identified people of interest to me, I can see what they've tagged and how they've tagged it. The more important step, however, is first finding these people by being able to identify them as neighbors. (Participant 11).

However, although these participants showed a relatively low degree of interactivity and negative view of the features, they certainly had a sense of the social interactions of the folksonomic system while tagging. Qualitative diary studies revealed that during tagging

both of them expressed a desire for unknown others to view their tags or bookmarks. For example, as noted before, Participant 7 was found to form some perceptions of other users during the study. He confirmed that he considered others' searching when he assigned a tag with a specific word: he added a tag in which he translated a foreign word into English so that other users could understand it (Participant 7, diary entry #7). This indicates that while he thought of his Delicious use as individually focused, nevertheless he was intentionally contributing to other users of the folksonomic system.

9.2 Community experiences: Collaboration and RSS feed subscription

Several participants identified themselves as engaging in social interaction on a folksonomic system through a community feature in the folksonomic system. Of the 12 participants, six reported that they had joined a group or network on a folksonomic system (Participants 1, 2, 5, 9, 10, and 11): among these, three participants said that they were engaged in two different groups (Participants 1, 10, and 11). The community feature allows participants to track what their colleagues or collaborators are reading, or to co-operate on the creation of reference collections. Connotea provides a 'Group' feature with which any user can create a public or private group, and all group members' new bookmarks are added

automatically to the group account. Similarly, CiteULike provides a 'Group' feature which allows participants to collaborate and to create a group reference. Delicious provides the feature of group functionality with 'Network' whereby participants can identify those in whom they are interested, and keep track of what members of their networks have bookmarked.

Participants were engaged in collaborative work through the community feature in a folksonomic system. They organized group work and collaborated for a particular task through the community feature. In such a case, members of a group tended to know each other outside of the folksonomic system, which is where most interactions happened. The following quotation comes from the participant who collaborated on the creation of reference collections through the 'Group' feature in CiteULike:

> We bookmark, share and discuss references at office meetings. We collaborate and brainstorm new ideas in the field via reference discovery […We use CiteULike as a] complement to research meetings [and] online and offline research brainstorming (Participant 10).

As well as collaboration, there was a way for participants to keep up to date with new content added to the folksonomic system through RSS feeds. An RSS feed refers to a computer readable file which summarizes the information published on the system over a recent time period. Subscribing to RSS feeds enables participants to more easily monitor

updates by those whom they're interested in. The following quotation illustrates how a participant used an RSS feed to aggregate and keep track of people of interest:

> We just keep our own individual collections. [I think in Connotea] the group functions as an easy aggregator. The RSS feed to the group provides an easy way to watch what other labmates are doing[…] My experience is all about the recent history features accessible and forgettable via the RSS feeds. I've added my connotea bookmark feed to my friendfeed account. [F]riendfeed is an aggregator for RSS feeds that lets users create personalized aggregate feeds (e.g., blog plus bookmarks plus music listened to on last.fm) and then share their feeds with other users (Participant 1).

Another participant noted that she used a network feature in Delicious, which shows the user name of those who subscribe to a user via the Delicious inbox, instead of subscribing to an RSS feed (Participant 5). In terms of watching Network in Delicious and subscribing to updated resources, she said "you don't have to stay on top of every source when you trust someone in your network to help you find stuff you may have missed" (Participant 5).

As evident in these quotations, these participants perceived that the community features supported social interactions on a folksonomic system. Their perceptions of social interaction through a community feature also influenced their tagging behaviors and tag usage. Qualitative diary studies revealed that these participants used a community feature in accessing new resources as well as in assigning tags (Participants 1, 8, 10, and 11). In terms of item selection, they added the latest or updated resources identified through RSS feeds

(Participants 1, 8, and 11). In terms of tag assignment, some participants used special types of tag such as task-organizing tags or reference tags, which indicated the resources were associated with a community as noted earlier (Participants 10 and 11).

On the other hand, some participants did not yet perceive any value of social interactions on a folksonomic system through a community feature. They might not have explored a feature fully nor be aware of how to use it effectively, even though they had joined a community in a folksonomic system. Comments that illustrate this finding were:

> We don't collaborate at all. I should use [Connotea 'Group' feature] more. I often forgot about it. There it should be some way to follow its [RSS] feeds or I should configure it to receive an email when a new article is added (Participant 2).

> I thought the group would be useful, but [C]iteulike doesn't really offer much functionality for group communication (Participant 9).

9.3 Conclusions: Social and interactive aspects of tagging

This chapter presents findings from the analysis of participants' use of the folksonomic system features that related to their social awareness and degree of interactivity. Participants' perceptions and experiences with community in a folksonomic system are discussed, exploring social interactions on a folksonomic system.

Participants were aware of the social potential of a folksonomic system and used

interactive aspects of tagging via various features of the folksonomic system while tagging: the popularity, link to related information, and exploration by tags or users. There appeared to be a relationship between the degree of interactivity and social awareness of participants. It was observed that participants certainly had a sense of the social interactions allowed by the folksonomic system in terms of social awareness. They felt that if they tag a resource they are interested in, then they are helping others who share similar interests to find it. Participants' community experiences including collaboration and RSS feed subscription in a folksonomic system also related to their perceptions of the social and interactive aspects of tagging. Through a community feature in a folksonomic system, they were engaged in social interaction whereby they obtained the latest or updated resources and assigned communicable tags.

Chapter 10 outlines the findings of the study and future work to be done, discusses the limitations of the study, and provides a conclusion.

10 SUMMARY AND CONCLUSION

10.1 Summary

10.1.1 Research purpose

Folksonomy has been developed as a new concept in user-created classification and communication through shared metadata in the Web environment. A folksonomy provides the potential to serve as a Web classification that allows users to interact within a system and to participate in the development of a classification system on the Web.

Despite increasing interest in folksonomy in practice as well as in research, earlier studies on folksonomy have most often presented a preliminary examination of issues involved with the structure of a folksonomy and suggested more empirical research. Yet little has been done to build a solid conceptual framework from which to understand how people classify Web resources using a folksonomy.

This study is an attempt to articulate a conceptual model that will help us better understand users' interactions with a folksonomy. The conceptual framework consists of three components of users' interactions with the folksonomy: (1) tagging – cognitive categorization of an individual user with a Web accessible resource; (2) navigation – exploration and discovery of Web accessible resources in the folksonomic system; and (3)

knowledge sharing – representation and communication of knowledge within a domain that consists of a group of users who share the same interests or goals.

The current study is the beginning of a larger research project to build a sound, comprehensive conceptual framework to understand users' interactions with a folksonomy. This study focuses on the first component of users' interaction with a folksonomy, tagging. The purpose of this study is (1) to examine how people are tagging in order to utilize a folksonomy in the practice of organizing Web resources; and (2) to examine whether and how people are interacting with a folksonomy through tagging. It is hoped that this study will provide insight into theoretical as well as practical issues regarding users' perceptions and use of folksonomy in accessing, sharing, and navigating Web resources.

10.1.2 Research questions

The research questions addressed in this study were:

1. How do participants tag a resource using a folksonomic system? What activities are involved in the tagging process?
2. What are the motivations of participants behind tagging activities? How do they relate their tagging motivations to their tag decision?

3. How do participants understand the social and interactive aspects of tagging? To what extent do they consider others' tags and tagging behaviors during tagging?

The primary focus of this study was to explore how individuals were tagging in order to utilize a folksonomy in the practice of organizing Web resources. This examination of tagging processes included the series of tagging activities involved, types of tags they used, and features of the folksonomic system they used. This research also examined the motivations of individuals behind their tagging activities, and how these motivations guided their tagging decisions. The research examined how individuals understood the social and interactive aspects of tagging, and how their perceptions affected their tagging activities. Looking at how individuals use and understand a folksonomy in organizing Web resources provided insights useful for developing a conceptual model to better understand interactions among users, a domain, and a folksonomic system. The answers to these research questions will strengthen our understanding of the use of a folksonomy in practice.

10.1.3 Research methodology

This study aimed to explore folksonomic system users' tagging behaviors as they engaged in folksonomic interactions, asking how they were tagging in order to utilize a

folksonomy; and whether and how they understand the social and interactive aspects of tagging. Since the research questions were exploratory and descriptive in nature, qualitative methods were used. The data collection and analysis focused on the tagging behaviors of users who were registered in three different folksonomic systems, Connotea (www.connotea.org), Delicious (http://delicious.com), and CiteULike (www.citeulike org). These three folksonomic systems were chosen for several reasons: (1) because of their popularity, they have a relatively large community of active users and provide a rich set of raw data on the structure of a folksonomy shaped by users' interactions; (2) they are all designed for saving and sharing Web pages and bookmarks, and single tagging events retain their identity and can be individually retrieved; (3) they are all broad folksonomies in which many people tag many different Websites as well as the same Web sites, as opposed to, for example, the photo folksonomic system Flickr, which is a narrow folksonomy, in which fewer people tag their own pictures with their own words (VanderWal, 2006); and (4) they provide several features that are relevant to our investigation of social and interactive aspects of tagging.

In order to investigate tagging behaviors engaged in folksonomic interactions, 12 participants were recruited through the mailing list and Web discussion board of three

different systems (Connotea, Delicious, and CiteULike). All agreed to participate, and data collection took place between September 2008 and March 2009. Each participant was asked to complete a Web questionnaire, the qualitative diary studies, and follow-up interviews. Derived from the research questions, the questions in the questionnaires asked participants about their perception and experience with tagging in using folksonomic systems: the demographics of participants, their tagging patterns, the types of tags that they used, the features of folksonomic system they used during tagging, and their overall experience with folksonomic systems. The in-depth description and analysis of participants' tagging behavior was based on data collected through diary studies and interviews with participants. All participants were asked to keep a Folksonomy diary, recording tagging events that occurred during their daily lives, for a period of a week. The Folksonomy diary was designed to capture information about participants' everyday use of folksonomic systems, including how they classified items in a specific category and how they named these categories with certain tags; the reasons why they chose to use these tags; and what features of folksonomic systems they used in the tagging processes. This diary data offered the exploratory and factual information which revealed the participants' usage of tags in using a folksonomic system in a natural setting without the distracting influence of the

researcher. Additional interviews with the participants were conducted via e-mail to complement the diary data.

Data analysis was conducted using inductive coding and the constant comparison method of grounded theory guided by Strauss and Corbin (1990) and Lincoln and Guba (1985). The text areas of the Web questionnaires and diary studies were coded openly, according to apparent themes, while short memos were written. A qualitative data analysis software program, NVivo 8 was used as a tool to manage the process of coding and linking concepts and to enable effective searching and retrieval of quotations. The second stage of the analysis was creating flowcharts of the participants' tagging processes based on data collected through the Web questionnaire, qualitative diary studies, and follow-up interviews. The coding scheme, initially developed from the results of pilot study and conceptual framework of this study, was refined as the data from the final study were examined. The coding scheme included concepts and categories that were related to an investigation of tagging behaviors engaged in folksonomic interactions: tagging activities involved in the tagging processes; tagging motivations; types of tags used; and features of the folksonomic system.

In order to help ensure trustworthiness and credibility of the finding, this study

employed triangulation in data collection through the use of multiple methods (Web questionnaires, diary studies, and follow-up interviews). Also, the study entailed frequent peer review, exercised reflexivity (researcher's reflections on his or her role, assumptions, worldview, and biases), and conducted a pilot study to practice data collection. The findings were shared with four of the participants and their feedback sought to enhance the credibility of the study in terms of member checks. The progress of the research was also tracked through a detailed account of methods, progressions, and decisions, by keeping a research journal.

10.2 Major findings

10.2.1 Research Question 1: Tagging processes

How do participants tag a resource using a folksonomic system? What activities are involved in the tagging process?

The flow charts developed from 12 participants showed that tagging was a quite complex process, comprising a series of activities. Three main tagging activities involved in the tagging process have been identified: item selection, tag assignment, and tag searching and discovery. The following summarizes the classification developed from the main

activities and emergent categories exploring the way in which participants tag resources using a folksonomic system:

- Item selection:
    - access Web resources;
    - add a new resource or copy from other's library and save it in their personal library; and
    - decide if they will keep the bookmark private or public in the system
- Tag assignment:
    - examine the bookmark for tagging;
    - add tags (generate new tag or copy tags from existing ones)
    - review assigned tags; and
    - edit tags (rename tags or delete tags)
- Tag searching and discovery:
    - browse tags; and
    - search for a specific tag

Although the process begins with the item selection, the stages that participants follow are not linear. In particular, the activities related to tag searching were not identified in the

sequence of steps in their tagging processes, and occurred sporadically. The entire process of tagging is a very complex one, in which each tagging activity is interconnected, and a variety of folksonomic system features are employed.

Participants' tagging began with item selection in which they accessed a Web resource and added it as a new bookmark into their personal library. They obtained a new resource in various ways: exporting resources from their personal sources (e.g., email or desktop); being informed by their exterior social network; or navigating through the folksonomic system features such as the popularity features and RSS subscription. During item selection, the distinction between accessing a resource and adding a bookmark, that is, a selected resource to save in the personal library, was not clear, except in the case in which participants obtained a given resource through browsing in the system and then copied it into their library. Participants' decisions about the privacy setting of a newly added bookmark were most often dependent upon their tagging motivations and their awareness of the social potential of a folksonomic system. Those who were aware that they could help others of similar interests tended to keep their bookmarks public; and some participants did maintain different privacy settings in their bookmarks, depending on their tagging purposes (i.e., personal information management purposes and social sharing purposes).

Tag assignment comprises a series of steps: examination of bookmark, adding tag, review of assigned tags, and editing tag. The preliminary bookmark examination was a very complicated process and a critical stage in their tagging processes, and it determined their subsequent tagging activities in general, and what type of tags they would use in particular. After the preliminary bookmark examination, participants generated new tags or evaluated related ones in order to copy them to the bookmark. During tag assignment, a variety of sources in a folksonomic system were considered: tags previously used by the participants themselves; tags suggested by the folksonomic system; and tags generated from other source of related tags and extensions. Participants reviewed the assigned tags in two ways, related to their tagging motivations: examining the completion of tagging or verification of assigned tags. This review guided participants' decisions about editing tags, whether they would rename, delete or leave tags intact. This decision was also associated with the assessment of the subject matter of the bookmark, or participants' personal management purposes.

During tagging, participants browsed tags which other users of the folksonomic system assigned, or searched for a specific tag. In tagging processes, the activities of tag searching and discovery were observed to interconnect with other activities: browsing tags connected

to item selection (access new information) and tag assignment (identify appropriate tags for the bookmark); and searching a specific tag connected to item selection (access the resource most relevant to their interests).

10.2.2 Research Question 2: Tagging motivations and tag decision

What are the motivations behind participants' tagging activities? How do they relate their tagging motivations to their tag decision?

In this study, seven different motivations behind tagging activities were identified: reuse information; keep track of information; manage references; share information with others; communicate with others; explore information; and organize information. During tag assignment, participants would describe these tagging motivations related to a specific type of tags: topic tags, format tags, source tags, refining tags, qualities tags, reference tags, and task-organizing tags.

Topic tags, or tags identifying what the bookmark is about, were the most commonly used by participants. Participants used topic tags to categorize their bookmarks through content representing hierarchical relationships between tags (with different degrees of specification); or different dimensions of the bookmark (by specifying its different aspects).

Format tags identifying what the bookmark is, were used as an indicator of the form of a reference or the medium associated with the bookmark. Source tags, identifying who owned or created the bookmark, were used as an indicator of where they had obtained the bookmark, most often specifying a user name within the folksonomic system, or a publisher. Refining tags were used as supplementary to other types of tags in order to represent the bookmark more precisely. Qualities tags were used to indicate participants' value judgment about the bookmark, or their emotional reaction to the bookmark. Reference tags identified referential relations to the bookmark they perceived while tagging, and were used as an indicator of the people with whom they wanted to share the bookmark. Task-organizing tags were used to indicate what they were working on in order to find specific information about specific tasks, or specify the function associated with the bookmark. With slight modifications to the refining, reference, and task- organizing tag types, this study provides confirmation for the tag types developed by Golder and Huberman (2006).

10.2.3 Research Question 3: Social and interactive aspects of tagging

How do participants understand the social and interactive aspects of tagging? To what extent do they consider others' tags and tagging behaviors during

tagging?

Participants were aware of the social potential of a folksonomic system and used interactive aspects of tagging via various features of the folksonomic system while tagging: the popularity, link to related information, and exploration by tags or users.

There appeared to be a relationship between the degree of interactivity and social awareness of participants. Some participants, who showed a relatively high degree of interactivity, learned with their experiences that the folksonomic system features helped them with accessing new resources as well as with assigning tags. Most participants lay between a high degree of interactivity and a low degree of interactivity; these were participants who have not explored the folksonomic system features fully. They perceived a social potential not fully realized, having either positive expectations of social interaction on a folksonomic system, or relatively negative expectations after a period of experience with a feature. Other participants with a relatively low degree of interactivity did not yet perceive a social and interactive component; or abandoned it having had unsatisfactory experiences with a folksonomic system feature.

It was observed in this study on social awareness that participants certainly had a sense of the social interactions allowed by the folksonomic system. They felt that if they tag a

resource they are interested in, then they are helping others who share similar interests to find it. During tagging, even those who showed a relatively low degree of interactivity were aware of the social aspects of tagging and used a specific tag to contribute to social sharing in a folksonomic system.

Participants' community experiences including collaboration and RSS feed subscription in a folksonomic system also related to their perceptions of the social and interactive aspects of tagging. Through a community feature in a folksonomic system, they were engaged in social interaction whereby they obtained the latest or updated resources and assigned communicable tags.

10.3 Limitations of the study

This study attempts to gain insight into the phenomena of folksonomy, how these phenomena reflect an interaction among users, a given domain, and folksonomic systems. However, the current study is limited to investigating the tagging behaviors of users involved with folksonomic interactions, how people are tagging to utilize a folksonomy among three components of folksonomic interactions: (A) tagging -- cognitive categorization of an individual user with a Web resource; (B) navigation -- exploration and

discovery of a Web resource in the folksonomic system; and (C) knowledge sharing -- representation and communication of knowledge within a domain. Although the proposed conceptual model of tagging behaviors and users' interaction with a folksonomy attempts to depict these three components involved in a folksonomic interaction as fully as possible, it may not cover all possible interactions completely.

Another limitation that must be considered is the inherent limitation of qualitative research due to sample size. A small sample size limits any generalization of the findings on a large scale, though it allows for a more in-depth exploration and understanding of users' interactions with a folksonomy. This study investigates users' tagging behaviors, based on only three different folksonomic systems. Therefore, specific issues identified may be quite different from those which would emerge from a study of another system. The selection of three folksonomic systems would not give compelling representation of users' folksonomic interactions as a whole and certainly does not provide a statistical basis for generalizing about users' tagging behaviors and interactions with a folksonomy. However, this study does offer a rich description of folksonomic system users' tagging behaviours based on the three folksonomic systems which were chosen due to their popularity and the commonality of features they provide based on purposive sampling.

In addition, while participants were representative of the real users of such folksonomic systems, the actual number was quite low, which limits our ability to generalize. These participants volunteered for this study, so it is likely that they possessed a special interest in folksonomic systems. Participants also apparently inhabited a particular work domain such as academic study, teaching and research and might have a certain level of expertise in resource description and evaluation. Therefore, it is not appropriate to generalize about users' tag usage and evaluation of folksonomy from these participants.

Another acknowledged limitation of this study is associated with data collection methods, i.e., questionnaire and diary studies. All data gathered are via self-report and, as such, may not reflect actual practice completely. The researcher relies on the willingness of participants to provide details; therefore, there is a risk that the data is not complete. To minimize this risk, the participants were provided with a structured diary format to record activities they engaged in while tagging as completely as possible. In addition, the follow-up interviews served to clarify issues regarding diary keeping.

10.4 Implication of findings

This study attempts to explore how people are tagging in order to utilize a folksonomic

system in the practice of organizing Web resources. It was conducted for the purpose of developing a conceptual framework that addresses users' interactions with a folksonomy. Relatively little empirical research has been done to build a conceptual framework in order to understand users' interactions with a folksonomy. In this study, a conceptual framework that consists of three different components from users' points of view was proposed: tagging, navigation, and knowledge sharing. It is hoped that this unified conceptual framework will provide insight into the ways in which a folksonomy can reflect an interaction among users, a domain, and a classification structure.

The current study was an attempt to test the first component, users' tagging behaviors engaged in the folksonomic interactions. An understanding of how individuals are tagging in order to utilize a folksonomy, which also helps laying the foundation for future research. The findings suggest that the entire process of tagging is a very complex one, in which each tagging activity is interconnected, and a variety of folksonomic system features are employed. Users were aware of the social potential of a folksonomic system and used interactive aspects of tagging via various features of the folksonomic system while tagging. It was observed that during tagging, users certainly had a sense of the social interactions allowed by the folksonomic system. They felt that if they tag a resource they are interested

in, then they are helping others who share similar interests to find it. These finding will be the foundations for a larger body of research focusing on the development of a theoretically sound conceptual framework for folksonomic interaction research.

In addition, this study suggests a different perspective to understand tagging behaviors and how they contribute to the structure of a folksonomy. This study uses information foraging and scent theory as a context to discuss how a folksonomy is constructed through interactions among users, a folksonomic system, and a given domain that consists of a group of users who share the similar interests or goal. Information foraging and scent theory provides a useful theoretical framework for this study, suggesting that through their folksonomic interactions, people constantly weigh information scent, laying trails by which they and their colleagues can relocate or identify useful materials.

Within this framework of information foraging, the study examined users' perception and use of tags as information scent which link resources and users to each other. The findings, including their perception of that information environment, suggest further investigation into more theoretical questions as well as practical design related to developing information scent in a folksonomic system. This approach will provide insight into conceptualization of a folksonomy and the act of tagging within a framework of

information foraging, which may differ from past studies of folksonomy focused on the function of tags in information retrieval. In terms of understanding of tags as information scent or navigational aids, the findings relating to the factors which affect users' interaction will also give insight a way to improve navigation effectiveness and to inform design in practice.

10.5 Suggestions for future work

This study is the beginning of a larger research agenda to investigate users' interactions with a folksonomy: tagging, navigating, and knowledge sharing. This phase has attempted to identify and provide some insights into individuals' tagging behaviors and into their awareness of the social and interactive aspects of tagging. The framework should be tested further using additional methods. In order to continue exploring the folksonomic interactions, several areas should be investigated.

A possible area of further research in the area of folksonomic interaction is a study of users' navigating behaviors: how users explore and discover new resources in a folksonomy, and how a folksonomic system supports users' navigation behaviors. An observational study focused on users' browsing and navigation behaviors will be helpful to explore the

different components involved in folksonomic interactions. This analysis could yield practical results when combined with transaction log analysis showing individuals' tagging behaviors and navigation patterns.

Participants in this study demonstrated a range of classificatory behaviors and developed their own classification 'systems' ranging from inexpert to quite sophisticated. Structures such as tagging rules, controlled vocabularies, term relationships, and even hierarchies (although relatively shallow ones) emerged in the investigation. While it was not the aim of this study to examine these user-generated classification schemes in detail, there is certainly an opportunity here for further research into end-user classificatory behavior. Whether these user schemes take a different form for personal information management and social sharing of resources is also an interesting question.

One way to proceed would be to study how and if groups of users constitute social norms or agreed-upon classification structure in a folksonomic system. Looking at how users who share common interests or goals build a domain in a folksonomic system; and how they contribute to the development of an agreed-upon classification structure, will also lead to a better understanding of folksonomic interactions. A focus group study with folksonomic system users who engaged in a collaborative work will be helpful to explore

this component of knowledge sharing in folksonomic interaction.

10.6 Conclusions

This study proposed a conceptual framework to recast a folksonomy as a Web classification, and to use this to explore the ways in which people work with it in accessing, sharing, and navigating Web resources. In order to better frame a user's interaction with a folksonomy, an information foraging approach was adapted that denotes adaptive information seeking behaviors of users within human information interaction. Within the information foraging framework, users' tagging behavior was understood as being related to information gathering and browsing behavior because they are constantly gathering, monitoring, and screening information when using a folksonomy. In this study, a conceptual framework that consists of three different components from users' points of view was proposed: tagging, navigation, and knowledge sharing. Focusing on the first component of folksonomic interaction, this study was an attempt to explore how users are tagging in order to utilize a folksonomy; and whether and how they are interacting with a folksonomy through tagging.

One of the findings concerns individual's understanding and use of tags as categories

that group like Web resources together in a folksonomic system. An investigation of folksonomic system users' tagging processes indicated that they were very aware of the function of tags as categories that collocated resources within an individual's personal collection, as well as across the entire folksonomic system. During tag assignment, folksonomic system users would describe their tagging motivations related to particular tags. Their perception of the usefulness of types of tags was different when their purpose was social sharing than when it was personal information management.

Another finding concerns individual's use and understanding of tags as information scent that help them to find related resources and users, and obtain desired information. By examining folksonomic system users' engaged experiences and reflection on their folksonomic interactions, this study suggested that they used and understood the interactive aspects of tagging. Folksonomic system users perceived that shared tags would function as information scent, guiding individuals to the information they seek and helping them to predict which resources will be pursued. While tagging, folksonomic system users recognized the social potential of a folksonomy system and used interactive aspects of tagging via various features of the folksonomic system.

It is hoped that this empirical study, exploring how individuals use and understand a

folksonomy in organizing Web resources, will help provide a realistic view of folksonomies as a Web classification. This study is exploratory research about the little known phenomenon of the tagging behaviors of users engaged in folksonomic interactions; therefore more empirical studies are necessary to expand the range of applicability as well as the level of validity, by accumulating findings from further study. Further studies from users' points of view on the different components of folksonomic interactions, that is, navigation and knowledge sharing, should be carried out to develop a theoretically sound conceptual framework for folksonomic interaction research.

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Appendix A1: Exemption Letter (minimal risk)

The University of British Columbia
Office of Research Services
Behavioural Research Ethics Board
Suite 102, 6190 Agronomy Road, Vancouver, B.C. V6T 1Z3

CERTIFICATE OF APPROVAL - MINIMAL RISK

PRINCIPAL INVESTIGATOR:	**INSTITUTION / DEPARTMENT:**	**UBC BREB NUMBER:**
Edie Rasmussen	UBC/Arts/Library, Archival & Information Studies	H08-00470

INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:

Institution	Site
UBC	Vancouver (excludes UBC Hospital)

Other locations where the research will be conducted:

Subjects will complete online questionnaires and diaries about their use of Coonotea, in their home or workplace.

CO-INVESTIGATOR(S):

N/A

SPONSORING AGENCIES:

N/A

PROJECT TITLE:

Classifactory approach to understanding folksonomy: the case of Connotea(www.connotea.org)

CERTIFICATE EXPIRY DATE: March 31, 2009

DOCUMENTS INCLUDED IN THIS APPROVAL:	**DATE APPROVED:** **March 31, 2008**	
Document Name	**Version**	**Date**
Protocol:		

research proposal	N/A	March 18, 2008
Advertisements:		
invitation for the study	N/A	March 18, 2008
Questionnaire, Questionnaire Cover Letter, Tests:		
questionnaire	1	February 26, 2008
Other:		
www.connotea.org		

The application for ethical review and the document(s) listed above have been reviewed and the procedures were found to be acceptable on ethical grounds for research involving human subjects.

Approval is issued on behalf of the Behavioural Research Ethics Board
and signed electronically by one of the following:

Dr. M. Judith Lynam, Chair

Dr. Ken Craig, Chair

Dr. Jim Rupert, Associate Chair

Dr. Laurie Ford, Associate Chair

Dr. Daniel Salhani, Associate Chair

Dr. Anita Ho, Associate Chair

Appendix A2: Exemption Letter (minimal risk renewal)

The University of British Columbia
Office of Research Services
Behavioural Research Ethics Board
Suite 102, 6190 Agronomy Road, Vancouver, B.C. V6T 1Z3

CERTIFICATE OF APPROVAL- MINIMAL RISK RENEWAL

PRINCIPAL INVESTIGATOR:	**DEPARTMENT:**	**UBC BREB NUMBER:**
Edie Rasmussen	UBC/Arts/Library, Archival & Information Studies	H08-00470

INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:

Institution	Site
UBC	Vancouver (excludes UBC Hospital)

Other locations where the research will be conducted:

Subjects will complete online questionnaires and diaries about their use of Connotea, Delicious, CiteULike in their home or workplace.

CO-INVESTIGATOR(S):

N/A

SPONSORING AGENCIES:

N/A

PROJECT TITLE:

Understanding a folksonomy as a Web classification: an empirical study

EXPIRY DATE OF THIS APPROVAL: January 16, 2010

APPROVAL DATE: January 16, 2009

The Annual Renewal for Study have been reviewed and the procedures were found to be acceptable on ethical grounds for research involving human subjects.

Approval is issued on behalf of the Behavioural Research Ethics Board

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Dr. M. Judith Lynam, Chair

Dr. Ken Craig, Chair

Dr. Jim Rupert, Associate Chair

Dr. Laurie Ford, Associate Chair

Dr. Daniel Salhani, Associate Chair

Dr. Anita Ho, Associate Chair

Appendix B. Recruitment Letter (Example from Connotea Study)

Hello,

My name is Heejin Park. I am a PhD student at the School of Library, Archival and Information Studies, University of British Columbia. I am conducting a study to fulfill the research component of my degree, and I am sending this note to ask for volunteers. In my research, I am interested in the use of Connotea (www.connotea.org) and looking for participants 19 years of age and older who will share their experiences with the system.

The purpose of this study is to explore how you use Connotea in order to access, share, and navigate Web information. The procedure will be a single, holistic case study design. If you agree to participate in this study, I would ask you to complete an e-mail questionnaire and/or to keep an electronic diary which records your use of Connotea. The e-mail questionnaire and diary process will take approximately two to three hours of your time over a two to three week period.

Participation in this research is voluntary, and participants are ensured confidentiality. The completed questionnaire will be accessible only to the researcher named below, and will be kept in strict confidence. The Connotea user name on the questionnaire is for data management purposes only. As soon as the responses are coded, information linking data to respondent will be destroyed. Please consider participating. To show our appreciation for your participation in this study, you will receive an honorarium in the amount of $20. If you would like to participate, to support the research, or because you would like to help out

a colleague please respond to this email address [**papermod@interchange.ubc.ca**]. If you do not wish to participate, but can recommend someone who can participate, please forward this message to that person.

If you decide to participate, I will give you a packet of information that includes a copy of the interview questions and electronic diaries, and my contact information. Please note that I have listed my e-mail account and my phone number below. Do not hesitate to ask any questions about the study.

Thank you very much.

Heejin Park
papermod@interchange.ubc.ca

Principal Investigators

Edie Rasmussen, Professor

School of Library, Archival and Information Studies

University of British Columbia;

Joseph Tennis, Assistant Professor

The Information School of the University of Washington

Appendix C. Invitation Letter (Example from Connotea Study)

Dear **

Thank you for agreeing to participate in this study.

The main purpose of this study is to obtain information on how you use Connotea in order to store, access, share, and navigate Web information.

By participating in this study, you are providing us full consent to use all information collected, including answers to the questions (which may include direct but anonymous quotations). You may refuse to participate or withdraw from the study at any time without any consequences. All responses will be held in the strictest of confidence. If you have any concerns about your treatment or rights as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598.

We would ask you to do the following things:

1) complete a questionnaire asking for some background information about your use of Connotea:

2) download a set of diary forms that I attach;

- We recommend that you make additional copies of the Connotea diary form as you need them. You need to record every activity involved with tagging (e.g., adding a bookmark to your library)
- Please use a separate form for each item you tag

- The aim of diary study is to observe your tagging activities in a natural setting
- We would like to see how you are actually using Connotea, so please do not forget to record your all activities when you use Connotea
- We would hope that you have in your Connotea diary at least ten entries in total (2 new activities per one day)

3) complete diary forms over a one week period. If you have not completed at least 10 entries by the end of a week, please continue for a second week.

4) send me back all your Connotea diary forms at the end of the one or two week period (papermod@interchange.ubc.ca)

As I mentioned in the invitation, you will receive an honorarium in the amount of $20 after you complete the study. Once your participation is complete, I will e-mail you an Amazon.com gift card.

I very much appreciate your decision to participate in this study.

If you have any questions, please do not hesitate to contact me.

Thank you very much, again.

Yours sincerely, Heejin

Heejin Park

papermod@interchange.ubc.ca

Appendix D. Questionnaire (Example from Connotea Study)

Dear Connotea user,

Thank you for agreeing to participate in this study. The main purpose of this study is to obtain information on how you use Connotea in order to store, access, share, and navigate Web information. By participating in this interview, you are providing full consent to the researcher for all information collected, including answers to the questions (which may include direct but anonymous quotations). You may refuse to participate or withdraw from the study at any time without any consequences. All responses will be held in the strictest of confidence. If you have any concerns about your treatment or rights as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598.

Part I-a. Background Questions (Page 1)

1. Connotea user name:

2. Age group:

__ 19-24 years

__ 25-34 years

__ 35-44 years

__ 45-54 years

__ 55-64 years

__ 64 years or older

3. Gender:

__ Male

__ Female

4. How long have you used Connotea?

5. How often do you use Connotea?

__ Less than once a week

__ Once a week

__ Two to three times per week

__ Four to six times per week

__ Once a day

__ Twice a day

__ More than twice a day

6. Have you ever used other social tagging systems (e.g., Del.icio.us, Flickr, CiteULike, Amazon product tagging, 43Things etc.)?

__ Yes

__ No (If No, please jump to the next page)

7. Please name the tagging systems that you have previously used or currently use.

8. If you are currently using a certain system, but stopped using, can you explain why?

9. If you used to use a certain system, but stopped using, can you explain why?

Part I-b. Background Questions (Page 2)

10. In your opinion, what is the purpose of Connotea? Please comment on any aspects that are interesting or useful to you.

11. How do you keep your references in Connotea?

__ I keep my entire set of references private

__ I keep my entire set of references public for anyone to see

__ I share my entire set of references with just the members of my group

__ I keep some references public, and others private

__ Others. Please describe: _____

12. In general, when you have an item to tag, do you have a process that you usually follow?

__ Yes (Please describe it in detain at the comment box)

__ No

□ If you answer yes, please describe your practice in this regard.

Part II. Types of tags (Page 3)

13. Could you provide specific examples of your tags, please? (Provide at least 3 examples)

Example 1:_____ Example 2:_____

Example 3:_____ Example 4:_____

Example 5:_____ Example 6:_____

Example 7:_____ Example 8:_____

The following questions are about the types of tags that you use. To jog your memory, you may find it useful to look through the following list of diverse kinds of tags for organizing the items, but please feel free to mention types of tags not listed here.

A. *Identifying what (or who) it is about*. Tags that identify the **topics** of bookmarked items.
B. *Identifying what it is*. Tags that identify what kind of thing a bookmarked item is, in addition to what is about. For example, **article, blog**, and **book**.
C. *Identifying who owns it*. Tags according to who owns or created the bookmarked content.
D. *Refining categories.* Tags that which do not seem to stand alone and, rather than establish categories themselves, refine or qualify existing categories. Numbers, especially round numbers (e.g., **25, 100**) can be used.
E. *Identifying qualities or characteristics.* Adjectives such as *scary, funny, stupid, inspirational* tag bookmarks according to the tagger's opinion of the content.

F. *Self reference.* Tags beginning with 'my' such as **mystuff** and **mycomments**.
G. *Task organizing*. Tags according to the task, such as **toread, jobsearch**.

14. Of the above list, which do you use the most? (Please rank your top three frequently-used types of tags).

1st most frequently-used types of tags:_____

2nd most frequently-used types of tags:_____

3rd most frequently-used types of tags: _____

☐ If you selected Other, please specify.

15. Of the above list, which do you think is the most useful in order to "manage" the items in your personal collection for your personal use? (Please rank top three most useful types of tags for your personal information management)

1st most useful types of tags for your personal information management: _____

2nd most useful types of tags for your personal information management: _____

3rd most useful types of tags for your personal information management: _____

☐ If you selected Other, please specify.

16. Could you elaborate why you think these types of tag are useful to you for "managing" your personal collection?

17. Of the above list, which do you think is the most useful in order to "share" the items in your personal collection with others in Connotea (Please rank your top three most useful types of tags for sharing with others)?

1st most useful types of tags for sharing: _____

2nd most useful types of tags for sharing: _____

3rd most useful types of tags for sharing: _____

□ If you selected Other, please specify.

18. Could you elaborate why you think these types of tag are useful to you for "sharing" the items in your personal collection in Connotea?

Part III. Connotea Features (Page 4)

The following questions are about your experience with the features that Connotea provides.

19. Active users.

On the Connotea homepage and the Popular links-page, there are lists of active users.

□ Have you ever used this feature?

__ Yes

__ No

□ Do you think it is useful to you?

__ Yes

__ No

- Why do you find it useful or not useful to you?

20. Popular tags.

On the Connotea homepage and the Popular links-page, there are also lists of popular tags.

- Have you ever used this feature?

__ Yes

__ No

- Do you think it is useful to you?

__ Yes

__ No

- Why do you find it useful or not useful to you?

21. Tag names.

You can click on tag names to see items that other users have saved under that tag.

- Have you ever used this feature?

__ Yes

__ No

- Do you think it is useful to you?

__ Yes

__ No

- Why do you find it useful or not useful to you?

22. Usernames.

You can explore further by clicking on other usernames to see what other links they've saved and what other tags they use.

- Have you ever used this feature?

__ Yes

__ No

- Do you think it is useful to you?

__ Yes

__ No

- Why do you find it useful or not useful to you?

23. Related tag names.

Connotea shows you related tag names that link to pages having a similar theme or topic.

- Have you ever used this feature?

__ Yes

__ No

- Do you think it is useful to you?

__ Yes

__ No

- Why do you find it useful or not useful to you?

24. Related user names.

Connotea also shows you related user names that link to the pages having a similar theme.

- Have you ever used this feature?

__ Yes

__ No

- Do you think it is useful to you?

__ Yes

__ No

- Why do you find it useful or not useful to you?

25. Are you a member of any user group in Connotea?

__ Yes

__ No (Please jump to next page)

- If you answer yes, please name your group.

26. How do you and your colleagues collaborate on the creation of reference collections?

27. Does this group form an important part of your Connotea experience?

__ Yes

__ No

□ If so, how?

Part IV. Comments (Page 5)

28. Based on your experience, what would you say are the strengths of Connotea in accessing, sharing, and navigating Web information?

29. Based on your experience, what would you say are the weaknesses of Connotea in accessing, sharing, and navigating Web information?

30. Please describe any additional thoughts you'd like to share with us to help us

understand how you are using Connotea to access, share, and navigate Web information.

Thank you for answering these questions about your use of Connotea! In the next part of the study, you will be documenting your use of Connotea with the diary forms you were provided with. Please contact me if you have any questions.

Heejin Park

papermod@interchange.ubc.ca.

Appendix E. Diary Form (Example from Connotea Study)

CONNOTEA DIARY

User name: _____

Instructions

- Please use a separate form for each item you tag
- The aim of the diary study is to observe your tagging activities in a natural setting. We would like to see how you are actually using Connotea, so please do not forget to record your all activities when you use Connotea
- We would hope that you have in your Connotea diary at least ten entries in total (average 2 new activities per day)
- We recommend that you make additional copies of the Connotea diary form as you need them. You need to record every activity involved with tagging (e.g., adding a bookmark)
- Please complete diary forms over a one week period. If you have not completed at least 10 entries by the end of a week, please continue for a second week
- Please return the set of forms to papermod@interchange.ubc.ca upon completion of the study

Thank you very much.
Please contact me if you have any questions.
Heejin Park
papermod@interchange.ubc.ca

CONNOTEA DIARY

** Please use a separate form for each item you tag*

Date and time: _____

Page Title/ URL: _____

Why are you tagging this item? _____

_____

_____

Tagging activity involved (Please select as many as apply):

☐ Edit bookmark ☐ Delete bookmark ☐ Add bookmark ☐ Copy from others

☐ Rename a tag: *old tag*: _____ → *new tag*: _____

☐ Other: _____

Do you share this bookmark? ☐ Share with all

☐ Keep this bookmark private to me

Tags you assigned in bookmarking this item	**Tag description: Why did you use this tag?**	**Used tag suggestion**
		☐ Yes ☐ No
		☐ Yes ☐ No
		☐ Yes ☐ No
		☐ Yes ☐ No
		☐ Yes ☐ No

Features of Connotea involved with this tagging activity (Please select as many as apply):

☐ Popular links ☐ Popular tags ☐ Active users ☐ Recently used tags

☐ Recently active users ☐ Related tags ☐ Related users ☐ Community pages

Appendix F. Reminder: Request for participation in Connotea diary study

Dear XXX,

This is a reminder about our request for your participation in Connotea study.
I'm looking forward to hearing from you.

1) IF you have not taken the questionnaire yet, please take the time to fill out it.
The questionnaire can be found at:
http://www.surveymonkey.com/s.aspx?sm=bduob9lBa3auKIJHhWMZsg_3d_3d

2) Please send me back the set of Connotea diary forms that you have recorded your tagging activities over a one week period. We are looking forward to it by tomorrow.
IF you have not completed at least 10 entries by now, please continue for a second week.

I would really appreciate your time and contribution given to this study.
If you have any questions, please do not hesitate to contact me.

Thank you again for your participation.
Yours sincerely, Heejin

Heejin Park
papermod@interchange.ubc.ca

Appendix G. Codebook

The top-level outline of the Codebook is as follows:

1. Tagging activities involved in the tagging process
    - 1.1 Item Selection
        - 1.1.1 Access Web resources
        - 1.1.2 Add a new resource (including Copy from other's library and save it in their personal library)
        - 1.1.3 Decide the privacy setting of the bookmark
    - 1.2 Tag assignment
        - 1.2.1 Examine the bookmark for tagging
        - 1.2.2 Add tags
        - 1.2.3 Review assigned tags
        - 1.2.4 Edit tags
    - 1.3 Tag searching
        - 1.3.1 Browse tags
        - 1.3.2 Search for a specific tag
    - 1.4 Other tagging activities
2. Tagging motivations
    - 2.1 Reuse information
    - 2.2 Keep track of information
    - 2.3 Manage reference
    - 2.4 Share information with others
    - 2.5 Communicate with others
    - 2.6 Explore information
    - 2.7 Organize information
3. Types of tags used
    - A. Topic
    - B. Format
    - C. Source
    - D. Refining
    - E. Qualities

F. Reference
G. Task-organizing

4. Features of folksonomic systems
   4.1 Popularity
   4.2 Searching by user/tags
   4.3 Link to related information (users or tags)
   4.4 Community participation
   4.5 Other features

1. Tagging activities involved in the tagging process

Group definition: the series of activities involved in the process by which the folksonomic system users assign tag to Web resources.

1.1 Item Selection

Concept definition: The activities involved with the process by which the folksonomic system users access a new Web resource and add it to their personal library.

NVivo Tree Node: item selection

1.1. 1 Access Web resources and add a new resource

Category definition: The activities involved with the process by which the folksonomic system users access a new Web resource. Also including the sources in which they obtain a new resource.

NVivo Tree Node: add bookmark

1.1.1. a Access new resources through human sources

Definition: Accessing a new Web resource through friends or colleagues of the folksonomic system users and saving it in their personal library.

NVivo Node: access through human sources

1.1.1. b Export new resources from existing references

Definition: Adding a new Web resource by importing resources from the existing references to their personal library (e.g., email, references saved in their desktop, existing references from their previous library in a folksonomic system) and saving

it in their personal library.

NVivo Node: export from personal references

1.1.1. c Access new resources using the folksonomic system features

Definition: Accessing a new Web resource through the features which the folksonomic system provides and saving it in their personal library.

NVivo Node: access through features

1.1.2 Copy a resource from others' library and save it in their personal library

Category definition: The activities involved with the process by which the folksonomic system users copy a new Web resource from others' libraries.

NVivo Tree Node: copy bookmark

1.1.3 Decide the privacy setting of the bookmark

Category definition: The activities involved with the process by which the folksonomic system users decide the privacy setting of the bookmark.

NVivo Tree Node: decide privacy setting

1.1.3. a Keep the entire bookmarks public

Definition: Folksonomic system users' decisions about keeping their tagged bookmarks publicly visible to anyone in a folksonomic system.

NVivo Node: keep bookmarks public

1.1.3. b Keep the entire bookmark private

Definition: Folksonomic system users' decisions about keeping their tagged bookmarks private only to their library.

NVivo Node: keep bookmarks private

1.1.3. c Keep some bookmark public and others private

Definition: Folksonomic system users' decisions about keeping some of their bookmarks public and other private in a folksonomic system. Including factors which they decide to maintain different privacy settings depending on the bookmark.

NVivo Node: keep different privacy settings

1.2 Tag assignment

Concept definition: The activities involved with the process by which the folksonomic system users assign tags for the bookmark. Including the ways in which they translate what they understand about the bookmark into terms (tags).

NVivo Tree Node: tag assignment

1.2. 1 Examine the bookmark for tagging

Category definition: The activities involved with the process by which the folksonomic system users analyze the bookmark in order to determine its representation.

NVivo Tree Node: examine bookmark

1.2.1. a Identify significant characteristics of the bookmark

Definition: What folksonomic system users perceive to be significant to present the

bookmark for tagging. Also including the ways in which folksonomic system users identify significant characteristics of the bookmark for tagging.

NVivo Node: identification of bookmark's significant characteristics

1.2.1. b Consider tag planning

Definition: Folksonomic system users' plans about tagging which relate to their tag assignment while they examine the bookmark; how to organize their tags and bookmarks.

NVivo Node: tag planning

1.2.2 Copy tags from existing ones

Category definition: The activities involved with the process by which the folksonomic system users copy tags from those previously used for the current bookmark. Also including the sources for tags where they evaluate and copy tags for the current bookmark and what features of folksonomic systems they use in copying tag.

NVivo Tree Node: copy tags from existing ones

1.2.2. a Copy tags from personal tag collection

Definition: Folksonomic system users' personal tag collections which they use to search for appropriate tags for the current bookmark.

NVivo Node: personal tag collection

1.2.2.b Copy tags from system-suggested tags

Definition: A list of suggested tags for the current bookmark which folksonomic

system users use to search for appropriate tags for the current bookmark. Including 'Tag suggestions' features of Connotea, CiteULike, and Delicious; and the features of 'Recommended Tags' and 'Popular Tags' of Delicious.

NVivo Node: system-suggested tag

1.2.2.c Copy tags from other related tags

Definition: A list of tags generated from other sources within a folksonomic system which folksonomic system users use to search for appropriate tags for the current bookmark. Including 'Popular tag', 'Related Tags', and 'Recently Used Tags' of Connotea; 'Popular Bookmarks' and 'Everyone's bookmarks for this Web page' of Delicious; and 'Find Related articles from this Web page' of Delicious; and 'Find Related articles from this CiteULike tag' of CiteULike.

NVivo Node: tag generated from other source

1.2.3 Generate a new tag

Category definition: The activities involved with the process by which the folksonomic system users generate an alternative expression for the current bookmark.

NVivo Tree Node: generate new tag

1.2.4 Review assigned tags

Category definition: The activities involved with the process by which the folksonomic system users review the assigned tags.

NVivo Tree Node: review tag

1.2.4. a Review the completion of tagging

Definition: Folksonomic system users' review of the assigned tags to see whether the tags have fully described the bookmark.

NVivo Node: completion of tagging

1.2.4.b Review the verification of the assigned tags

Definition: Folksonomic system users' review of the assigned tags to see whether the assigned tags are appropriate to describe the bookmark, or whether editing of tags is necessary.

NVivo Node: verification of tagging

1.2.5 Edit tags

Category definition: The activities involved with the process by which the folksonomic system users determine whether they will rename, delete, or leave tags intact. .

NVivo Tree Node: edit tag

1.2.5. a Rename tags

Definition: Folksonomic system users' decisions about renaming tags which are considered as not appropriate to represent the bookmark, and involved activities.

NVivo Node: rename tag

1.2.5.b Delete tags

Definition: Folksonomic system users' decisions about deleting tags, which are considered as not appropriate to represent the bookmark, and involved activities.

NVivo Node: delete tag

1.2.5.c Leave tags intact

Definition: Folksonomic system users' decisions about leaving tags, which are considered as not appropriate to represent the bookmark, intact, and involved activities.

NVivo Node: leave tag intact

1.3 Tag searching/ discovery

Concept definition: The activities involved with the process by which the folksonomic system users discover or search for a specific.
NVivo Tree Node: tag searching

1.3. 1 Browse tags

Category definition: Folksonomic system users' activities involved with browsing the tags which other users of the folksonomic system assigned, thereby discovering new information in the folksonomic system.

NVivo Tree Node: browse tag

1.3.1. a Browse the most popular or recent tags

Definition: Folksonomic system users' activities involved with browsing a set of the latest or most popular tags used to describe all the bookmarks posted to the folksonomic system while tagging. Including use of the popularity features of the folksonomic system.

NVivo Node: browse popular tag

1.3.1. b Browse related tags using the LI features

Definition: Folksonomic system users' activities involved with browsing a set of the latest or most popular tags used to describe all the bookmarks posted to the folksonomic system while tagging. Including use of the features of link to related information provided by the folksonomic system.

NVivo Node: browse related tag

1.3.2 Search for a specific tag

Category definition: Folksonomic system users' activities involved with searching for a specific tag (entering a subject of keyword query for the candidate tags) in a folksonomic system, thereby discovering new information in the folksonomic system.

NVivo Tree Node: search tag

1.4 Other tagging activities

Concept definition: The activities identified not fit into any of the other categories (item selection, tag assignment, and tag searching) during tagging, and difficult to identify any further relationship with the rest of the tagging activities.

NVivo Tree Node: other tagging activities

1.4. 1 Add a new member to the community in a folksonomic system

Category definition: Folksonomic system users' activities involved with adding a new member to the community which they engaged in.

NVivo Node: add group member

1.4.2. Edit the setting of bookmark

Category definition: Folksonomic system users' activities involved with editing the information about the tagged bookmark (e.g., the title of bookmark).

NVivo Node: edit bookmark.

2. Tagging motivation

Group definition: Folksonomic system users' motivations to tag a specific resource.

NVivo Tree Node: tagging motivation

2.1 Reuse information

Concept definition: Folksonomic system users' tagging motivations to tag a specific resource in order to make it more findable and easily accessible.

NVivo Node: reuse info

2.2 Keep track of his own progress or information

Concept definition: Folksonomic system users' tagging motivations to tag a specific resource in order to keep their own progress or information.

NVivo Node: keep track own progress

2.3 Keep track of similar-minded people

Concept definition: Folksonomic system users' tagging motivations to tag a specific resource in order to keep track of similar-minded people. Also including keeping track of similar-minded people via an RSS feed subscription which a folksonomic system provides.

NVivo Node: keep track others' info

2.4 Create/ maintain personal references

Concept definition: Folksonomic system users' tagging motivations to tag a specific resource in order to create or maintain their own personal references using a folksonomic system.

NVivo Node: manage personal ref.

2.5 Collaborate to create/ maintain group references

Concept definition: Folksonomic system users' tagging motivations to tag a specific resource in order to collaborate to create or maintain references of a community which they engage in, using a folksonomic system.

NVivo Node: manage group ref.

2.6 Share information with others

Concept definition: Folksonomic system users' tagging motivations to share information with colleagues or students.

NVivo Node: share info.

2.7 Express individual' own opinions about the tagged bookmark

Concept definition: Folksonomic system users' tagging motivations to express their own thoughts or opinions about the tagged bookmark in a folksonomic system.

NVivo Node: express own opinions

2.8 Network with similar-minded people

Concept definition: Folksonomic system users' tagging motivations to network or discuss about the tagged bookmarks with similar-minded people in a folksonomic system.

NVivo Node: network with others

2.9 Advertise individual's own articles to others

Concept definition: Folksonomic system users' tagging motivations to promote individual's own articles to other users in a folksonomic system.

NVivo Node: advertise own paper

2.10 Explore related information

Concept definition: Folksonomic system users' tagging motivations to discover interesting information by browsing or searching a folksonomic system.

NVivo Node: explore info.

2.11 Keep related bookmarks together

Concept definition: Folksonomic system users' tagging motivations to keep related bookmarks together in a folksonomic system.

NVivo Node: organize info.

3. Types of tags folksonomic system users use

Group definition: The types of tags that folksonomic system users use during tagging. Also including the functions they perceive their tags performing.

NVivo Tree Node: types of tags

3.1 Topic tags

Category definition: Tags which folksonomic system users use to identify what the bookmark is about. Including the ways in which they categorize the bookmarks through content with different degrees of specification (establishing a hierarchical structure) or different dimensions (establishing a horizontal structure).

NVivo Tree Node: topic tag

3.1.1 Establishing a hierarchical structure

Definition: Categorization of the bookmark through content by the breadth of the subjects. Including the way in which folksonomic system users represent the hierarchical relationships between individual tags through tagging.

NVivo Node: hierarchical structure with topic tags

3.1.2. Establishing a horizontal (analytical) structure

Definition: Categorization of the bookmark through content by the different dimensions of the bookmark through tagging, without any concern about the degree of specificity. Including the ways in which folksonomic system users analyze the topics associated with the bookmark by assigning multiple topic tags and synthesize those tags in order to provide a specific description of the bookmark.

NVivo Node: horizontal structure with topic tags

3.2 Format tags

Category definition: Tags which folksonomic system users use to identify what the bookmark is, or the form of provision of the bookmark.

NVivo Node: format tag

3.3 Source tags

Category definition: Tags which folksonomic system users use to identify who owned or created the bookmark. Also including the tags which they use to indicate

where they obtain the bookmark (e.g., a specific user name or publisher).

NVivo Node: source tag

3.4 Refining tags

Category definition: Tags which folksonomic system users use to refine or qualify existing tags including numbers, especially round numbers (e.g., 25, 100). Also including the tags which represent geography-specific or time-specific information associated with the bookmark, and indicate specific features of the bookmark.

NVivo Node: refining tag

3.5 Qualities tags

Category definition: Tags which folksonomic system users use to identify their value judgment about the bookmark.

NVivo Node: qualities tag

3.6 Reference tags

Category definition: Tags which folksonomic system users use to identify content in terms of its relation to themselves (taggers) as well the specific users or target audience with whom they want to share the bookmark.

NVivo Node: reference tag

3.7 Task-organizing tags

Category definition: Tags which folksonomic system users use to represent a task they perform and specify the associated function with the bookmark. Also including tags which are used to represent specific projects they worked on.

NVivo Node: task-organizing tag

4. Features of folksonomic system

Group definition: The feature of folksonomic system that folksonomic system users use during tagging. Also including the ways in which they understand the social and interactive aspects of tagging while use the features.

NVivo Tree Node: system features

4.1 Popularity features

Concept definition: Features of folksonomic systems that provide a set of the latest or most popular tags used to describe all the bookmarks posted to a folksonomic system. Also including the features that provide a list of users who have posted the most articles to their libraries in a folksonomic system.

NVivo Tree Node: popularity feature

4.1.1 Connotea popularity features

Category definition: Popularity features of Connotea which users use during tagging. Including the features, 'Active users', 'Popular users', and 'Popular tags' of Connotea.

NVivo Node: CN popularity

4.1.2 Delicious popularity features

Category definition: Popularity features of Delicious which users use during tagging. Including the features, 'Popular bookmarks' and 'Popular tags' of Delicious.

NVivo Node: DL popularity

4.1.3 CiteULike popularity features

Category definition: Popularity features of CiteULike which users use during tagging. Including the features, 'Everyone's library' and 'Everyone's tags' of CiteULike.

NVivo Node: CU popularity

4.2 Exploring (tags/ users) features

Concept definition: Features of folksonomic systems that enable users to find bookmarks that contain their chosen keywords across a folksonomic system. Also including the features for quickly going to tag and user listings.

NVivo Tree Node: exploring feature

4.2.1 Connotea exploring features

Category definition: Exploring features of Connotea which users use during tagging. Including the features, 'Tag names' and 'User names' of Connotea.

NVivo Node: CN exploring

4.2.2 Delicious exploring features

Category definition: Exploring features of Delicious which users use during tagging. Including the features, 'Explore a tag' and 'Go to a user' of Delicious.

NVivo Node: DL exploring

4.2.3 CiteULike exploring features

Category definition: Exploring features of CiteULike which users use during tagging. Including the features, ‘Tags’ and ‘Users’ of CiteULike.

NVivo Node: CU exploring

4.3 Link to related information features

Concept definition: Features of folksonomic systems that link to related tags or users.

NVivo Tree Node: Link to RI feature

4.3.1 Connotea features of link to related information

Category definition: Features of Connotea that link to related information which users use during tagging. Including the features, ‘Related tag names’ and ‘Related user names’ of Connotea.

NVivo Node: CN link to RI

4.3.2 Delicious features of link to related information

Category definition: Features of Delicious that link to related information which users use during tagging. Including the features, ‘Related tags’ and ‘Everyone’s bookmarks for this Web page’ of Delicious.

NVivo Node: DL link to RI

4.3.3 CiteULike features of link to related information

Category definition: Features of CiteULike that link to related information which users use during tagging. Including the features, ‘Related tags’, ‘Find related

articles with these CiteULike tags', and 'Find related articles with these CiteULike users'.

NVivo Node: CU link to RI

4.4 Community participation features

Concept definition: Features of folksonomic systems that enable users to set up or join a user community in a folksonomic system.

NVivo Tree Node: community feature

4.4.1 Connotea community participation features

Category definition: Community participation feature of Connotea which users use during tagging. Including the feature, 'Group' of Connotea.

NVivo Node: CN community

4.4.2 Delicious community participation features

Category definition: Community participation feature of Delicious which users use during tagging. Including the feature, 'Network' of Delicious.

NVivo Node: DL community

4.4.3 CiteULike community participation features

Category definition: Community participation feature of CiteULike which users use during tagging. Including the feature, 'Group' of CiteULike.

NVivo Node: CU community